THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. MARCH 25, 1897. CHICAGO, ILL. NUMBER 12.

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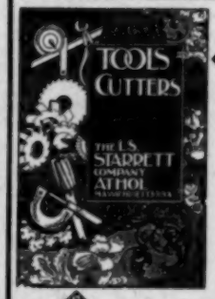

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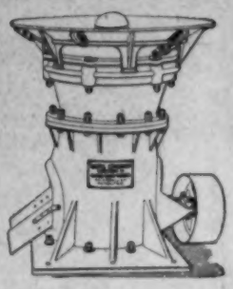

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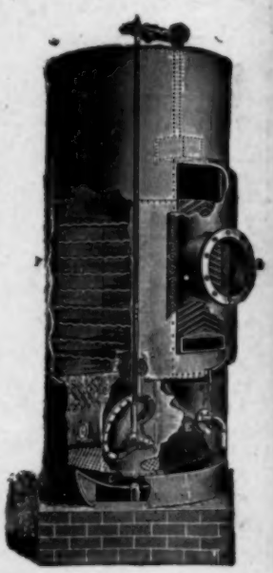

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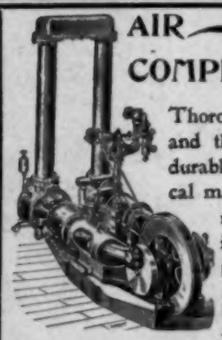

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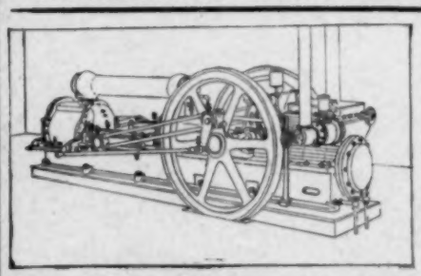

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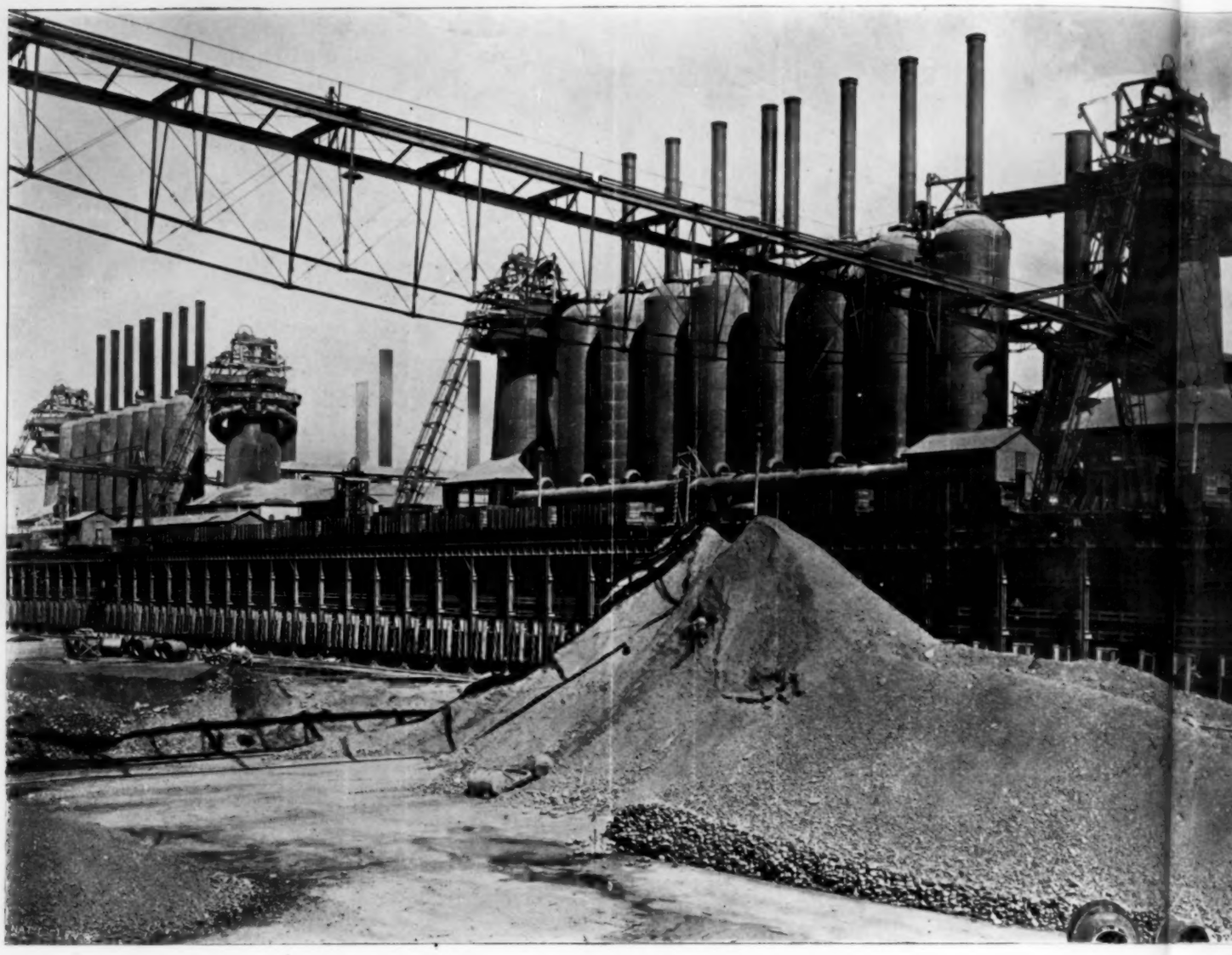


FIG. 6.

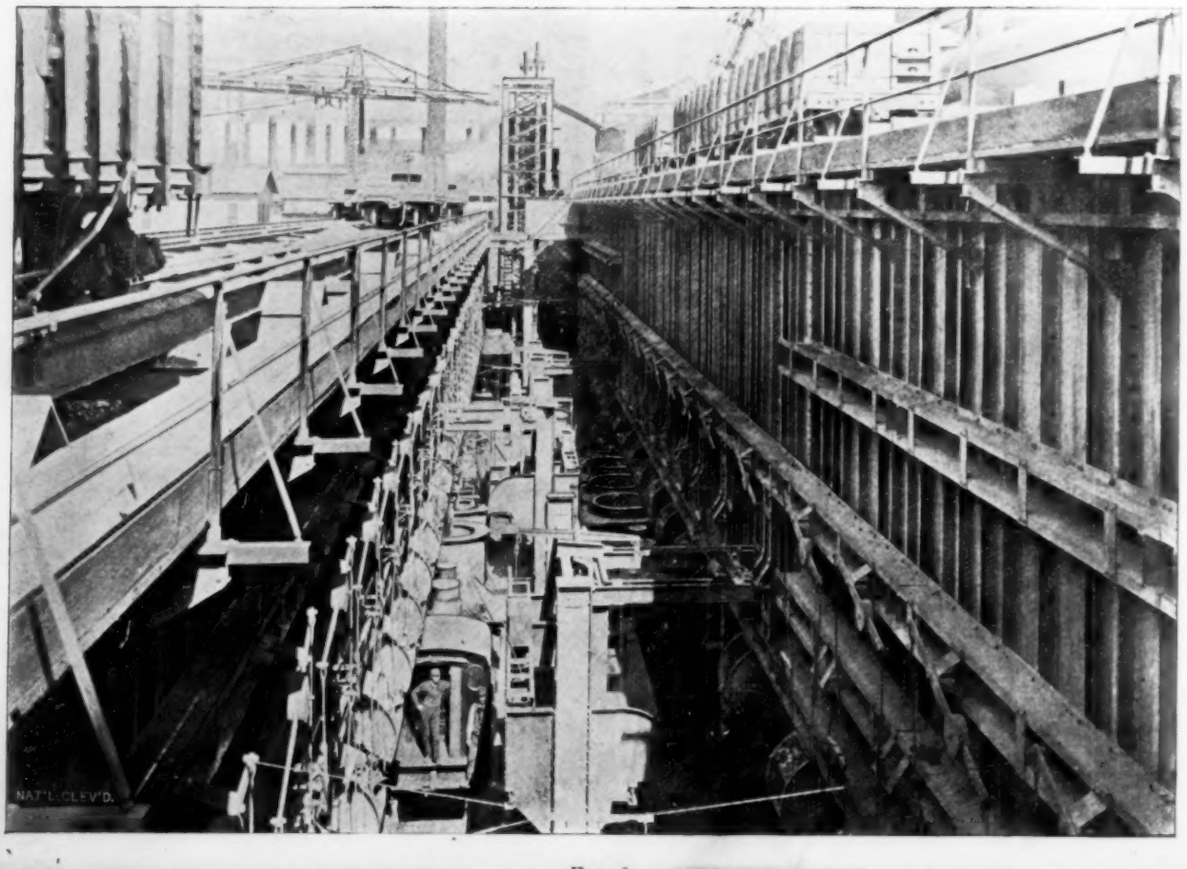


FIG. 8

FIG. 8 shows two tr
tion under the chutes,
beneath the bins, an
the left and coke an
train on the right. Th
are higher and larger
for ore. Fig. 9 shows
the ore stock yard, ta
point on the tracks th
the ore bins.

SUPPLEMENT TO
The Iron Trade Re
XXX, No. 12, Cle
March 5, 1897.

FIG. 6 takes in the furnace plant complete, showing nearly completed Furnaces 3 and 4 on the right and Furnaces 1 and 2 on the left. A portion of the ore pit is in the foreground, with the bucket, manipulated by the operator of the trolley, in position to be pulled up the side of the pile. Fig. 7 is a view of Furnace 2 at close range. A bucket of ore is at the top. Extending from the cast house to the car on the upper track, is the scrap carrier of No. 2 Furnace. The four views given are from photographs by Bell, of Pittsburg.

FIG. 7.

s shows two trains in position der the chutes, in the yard n the bins, an ore train on and coke and limestone n the right. The coke bins her and larger than those

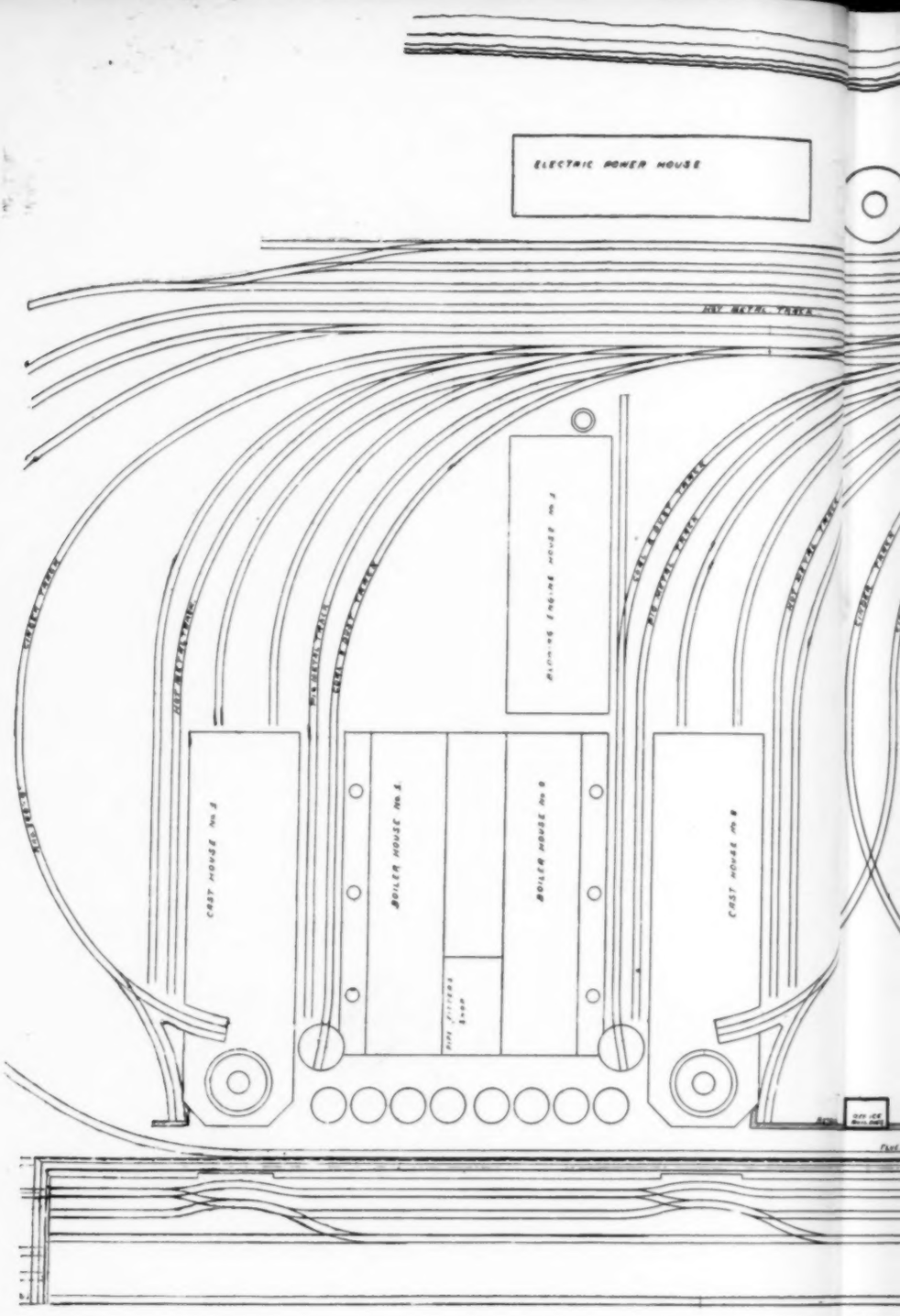
Fig. 9 shows a portion of stock yard, taken from a n the tracks that run over bins

FIG. 9

EMENT TO

Iron Trade Review, Vol. X, No. 12, Cleveland, O., rch 5, 1897.

The Duquesne Furnaces of the Carnegie Steel Company, Ltd.



G. I.

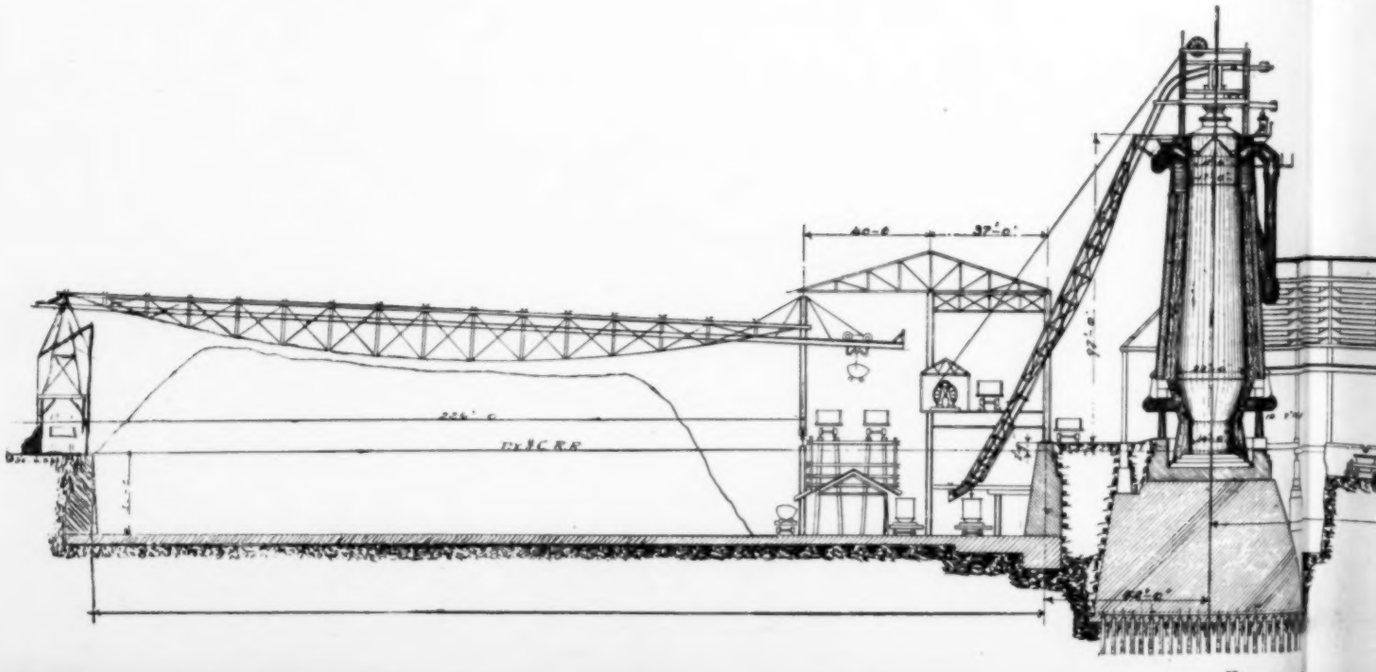
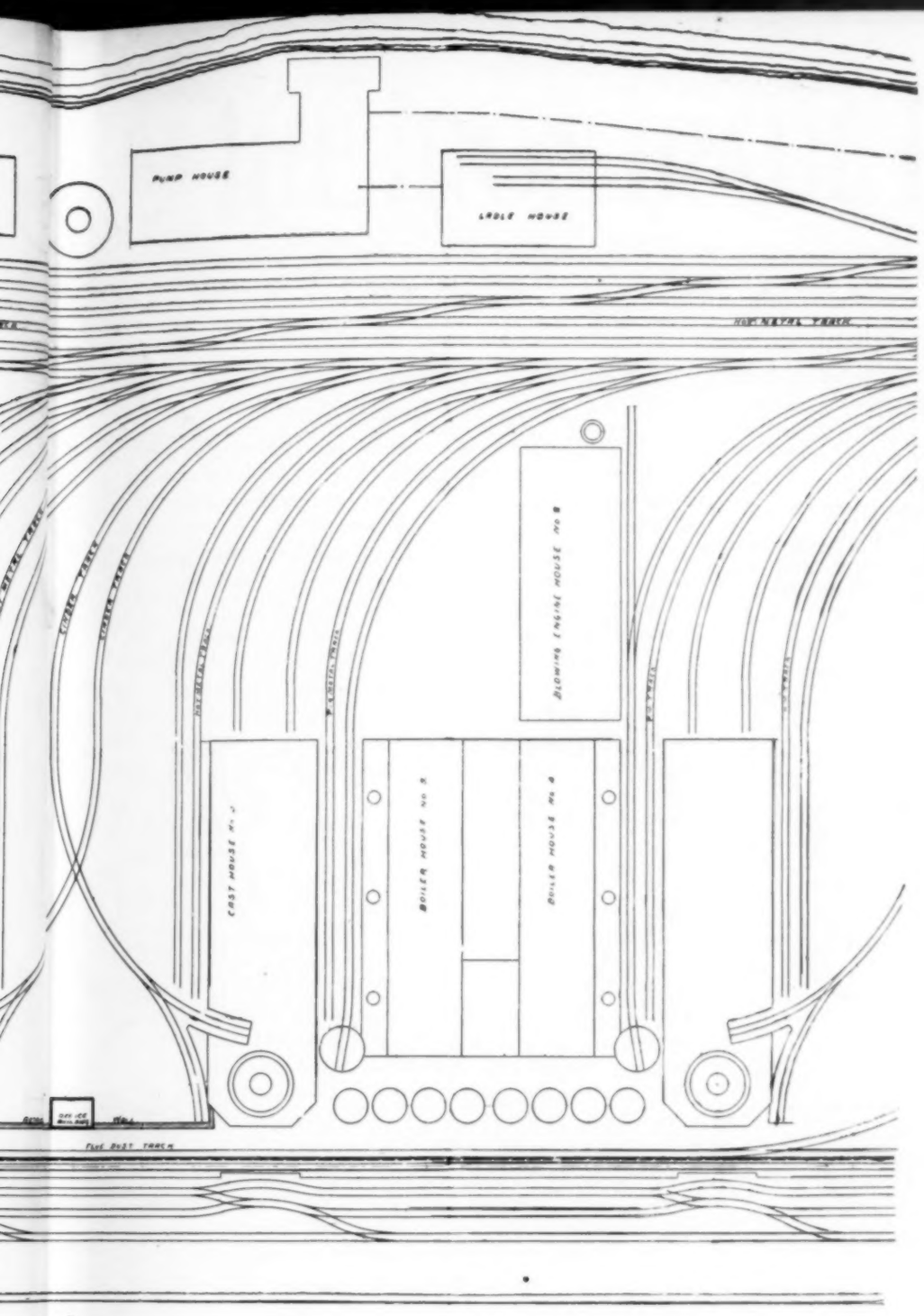


FIG. 2.



G. 1.

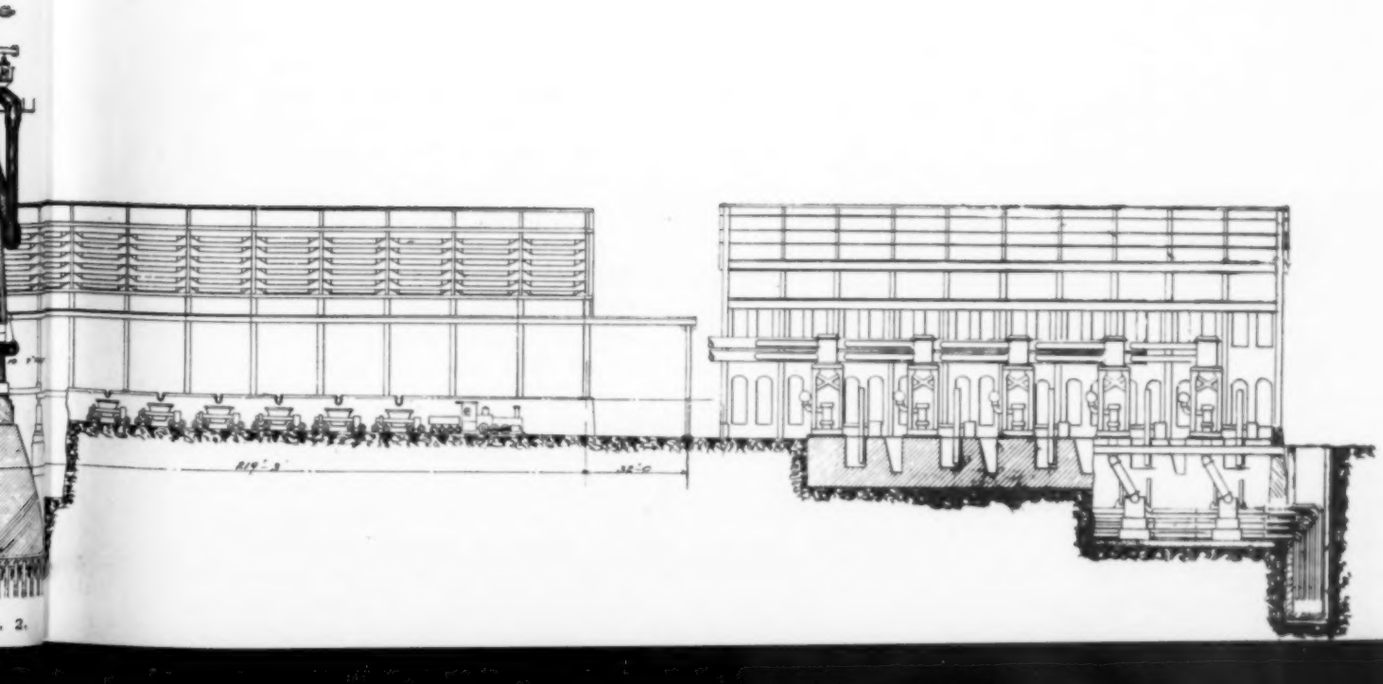


Fig. 1 is a plan view of the Duquesne furnace plant and yards, between the ore stock yard and the Monongahela River. Fig. 2 is a cross-sectional elevation through the ore stock yard, bins, furnace, and blowing engine house, with external view of the cast house.

SUPPLEMENT TO

The Iron Trade Review, Vol. XXX, No. 12, Cleveland, O., March 25, 1897.

THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. MARCH 25, 1897. CHICAGO, ILL. NUMBER 12.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The week has brought the dissolution of the old association of Lake Superior producers of Bessemer ores, and the decision of old-range companies to form a new organization. The halt in the Bessemer pig iron market, pending the decision of the ore question, may now be followed by some activity, but it need not be said that the events of the week will work no improvement in the price of Bessemer iron. A $2.65 price for Norrie ore and $2.40 as the maximum for any Mesabi ore other than Franklin or Biwabik, means that Bessemer iron from 1897 mixtures is likely to be sold in the valley below $9.50, even on $1.50 coke. Such a price for Norrie, and relative prices for other ores of Bessemer grade, is practically down to the level that the sharpest competition would bring. All that is gained to the old ranges is the holding of a line below which it will be known in advance that prices will not go, at any time in the year. Furnacemen can buy early with the assurance that the market will not slip away, to the advantage of a waiting competitor. The new basis makes mine ownership by consuming interests a superfluity. The furnace without mining connections practically gets the producer-consumer's price, with none of the risks of mine ownership. That there will be an unprecedented production of Lake Superior ores this year is foregone. It is evident from recent developments—and the refusal of a leading interest to consent to any arrangement on ore that would hold prices above the lowest level, gives confirmation—that the tonnage of low-priced rails, billets and other material booked for this year is even above any estimates yet made. All indications point to a year of enormous output, on a low level of prices. So far as the past week is concerned, new business has been scarce in the Pittsburg and Eastern markets. Fifty miles of gas pipe for Indiana was sharply competed for by wrought pipe mills and went at a low price. Bessemer iron has been inactive at Pittsburg, with $9.75 or a shade lower in the valley reported as a possibility. The billet inquiries noted a week ago have resulted in one 6,000-ton sale, and attempted resales of material bought early in the year are reported, the basis of offers being $15.25 and $15.50, Pittsburg. The stronger feeling apparent a week ago was only short-lived. The indications still are that large billet purchases must be made in the second quarter, because original sellers will be busy on rails. Chicago notes larger activity in the week, with considerable sales of material, including bar iron, plates and merchant steel, with a good outlook for architectural work. Steel bars continue very low, and bar iron, though in better demand in the West, owing to recent car orders, has sold down to 1c, Ohio and Indiana mills.

THE CLEVELAND DISTRICT.

The Bessemer Ore Association, contrary to expectations recently entertained by those most active in negotiating an arrangement for 1897, passed out of existence on Tuesday, as referred to more in detail elsewhere. The Mesabi range being thus taken out of the account, the old-range producers held a meeting and decided that an association of Marquette, Menominee, Gogebic and Vermilion range companies mining Bessemer ores be formed, on a basis of $2.65 a ton for an ore carrying 63 per cent in iron, .04 in phosphorus and 10 per cent moisture. A committee was appointed on a price schedule and allotments, to report not later than next Tuesday. The effect of the new turn in ore on lake freights for 1897 cannot be fully gauged. Opening rates will be low, owing to the small amount of grain to be moved. With a very heavy tonnage of ore assured, at the low prices, the latter part of the season may show advancing rates, of which some vessel owners will keep themselves in readiness to get the advantage. One prominent shipper has been offered tonnage through the season at 70 cents from the head of the lake, and on this is based some talk of a rate of 65 cents to Oct. 1. The probabilities as to Escanaba season charters are indicated by bids recently submitted on ore to South Chicago, ranging from the equivalent of 46 cents to 53½ cents, figuring in dock charges, or 30 to 37½ cents free.

Pig Iron

No sales of Bessemer iron are reported from the valleys the past week. The present weakness cannot be attributed to middlemen, some of the latter, at least, having $10 iron on their hands, which the breaking of the ore pool has depressed. The figures named by buyers in late offers are reported to be $9.65 to $9.75. Foundry irons are exceedingly quiet. The establishment of a single selling agency for Lake Superior charcoal iron is accompanied with no change in price. Competition of coke irons and of charcoal brands from other districts is a modifying influence. Gray forge iron is quoted $8.65 to $8.75 in the valley. The Mahoning Valley Iron Co.'s Hannah furnace, Youngstown, has blown out and Hazelton furnace of Andrews Bros.' Co., has banked. We quote:

Bessemer	10 40@10 65	Valley Scotch No. 1	$10 75@10 90
No. 1 Strong Foundry	10 65@10 90	Valley Scotch No. 2	10 25@10 50
No. 2 Strong Foundry	10 15@10 40	Gray Forge	9 50@ 9 65
No. 3 Foundry	9 75@ 9 90	Lake Superior Charcoal	13 50

Finished Material.

Steel products have a steady run of orders, but the tonnage is not large. Prices are unchanged at 1.05c, Cleveland, for steel bars and bar iron, 1.95c for No. 27 black sheets, 1.65c for beams and channels, 1.20c to 1.25c for tank steel. Beyond the 1,000 to 1,200 tons of material for the new revenue cutters to be built in Cleveland and 2,000 tons of elevated work to be built in this district for Chicago, there is no important tonnage pending. Valley mills are able to make little if any enlargement in their operations. It is doubtful if the present rate averages more than 25 or 30 per cent of capacity. The greatest activity is in spikes and other railroad specialties.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, March 24.

Quite large sales of some classes of material were made last week, and in almost every branch some improvement is reported. Consumers, as a rule, are very much more inclined to consider placing orders than they have been, and their requirements appear to be increasing steadily. Everything seems to indicate that the market is on the verge of a decided improvement which may be expected at any time and will probably come within a very short time.

PIG IRON.—Northern furnaces report a quiet week with but little more inquiry than they had the week before. Sales have been limited to comparatively small lots and the demand does not indicate any remarkable increase in sales in the immediate future. There is, however, a steady improvement noticeable, and orders are increasing a little both in size and in number every week. The Iroquois furnace blew out on Wednesday of last week, for repairs, which will take about three weeks to complete. Prices of Northern iron are maintained very firmly. Southern furnaces report an increase in inquiry and in sales. Orders for one or two round lots of Southern iron were closed last week. Prices are unchanged, and while most of the business closed is taken by the smaller furnaces at about the figures we quote, the larger Southern furnace companies are asking quite a little more for their iron.

Lake Sup. Charcoal	$13 50@14 00	Southern No. 1 Soft	$10 65@10 90
Local Coke Fdy. No. 1	11 25@11 75	Southern No. 2 Soft	10 15@10 25
Local Coke Fdy. No. 2	10 75@11 25	South'n Silveries	11 40@11 65
Local Coke Fdy. No. 3	10 50@10 75	Jackson Co. Silveries	14 00@16 00
Local Scotch Fdy. No. 1	11 25@11 75	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	10 75@11 25	Ohio Silveries No 2	14 50@15 00
Local Scotch Fdy. No. 3	10 50@10 75	Ohio Strong Softeners	12 00@12 25
South'n Coke No. 1	11 00@11 25	Alabama Car Wheel	16 00@16 50
South'n Coke No. 2	10 25@10 40	Malleable Bessemer	12 00@12 25
South'n Coke No. 3	10 00@10 15	Coke Bessemer	13 00@13 50

BAR IRON.—Several contracts of good size for iron for use in cars were placed last week. General business has been fairly good and continues to improve. Quotations on common iron continue to be made at 1.15c by most of the mills, but reports are heard that lower figures are being made and that one small Indiana concern has been quoting as low as 1c. Soft steel bars from strictly billet stock are maintained at 1.15c to 1.25c.

RAILS AND TRACK SUPPLIES.—A few small orders for standard sections were closed last week but most of the railroads appear to have filled their requirements and there is small prospect for much business in the immediate future. Light sections are in good demand and several contracts have been closed within the week. The inquiry for track supplies has not been especially large but is expected to increase as the railroads get shipments on their contracts for rails. Quotations are made: Rails, $21 to $23, according to specifications; steel splice bars, 1.20c to 1.30c; track bolts with square nuts, 1.95c to 2c; hexagon nuts, 2.05c to 2.10c; spikes, 1.65c to 1.75c.

BILLETS AND RODS.—About 6,000 tons of rods were sold by a local mill last week at $23.50. There are several other inquiries in the market which will be filled soon. Billets are quiet at $17 and no sales have been made.

STRUCTURAL MATERIAL.—Permits for four 14-story buildings on Dearborn street were issued to one person last week and have caused considerable speculation among contractors and steel men. It is doubtful, however, if these buildings are erected in the very near future. No large contracts of any kind were placed last week and no new ones have come up to bid upon. There are several projects requiring considerable structural material being considered in this city, and it is likely that some of them will materialize very soon. General business was a little quieter last week, but the outlook is excellent. Quotations are as follows: Beams and channels, 1.75c to 1.80c; angles, 1.25c to 1.30c; plates, 1.25c to 1.30c; tees, 1.50c to 1.55c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—There is quite a noticeable improvement in the demand for plates and orders last week were of considerable volume. Most of the business was for shipment from mill, but store orders are also increasing. Prices are made as follows: Tank steel, 1.25c to 1.30c; flange steel, 1.35c to 1.45c; fire-box, 2c to 5c.

SHEETS.—Both black and galvanized sheets are in good request and the business closed last week was very fair. Quotations are made at 2.10c to 2.20c for No. 27 black and 80 to 80 and 5 per cent discount for galvanized.

MERCHANT STEEL.—Business from store was very good last week and orders from mill show quite a little improvement. Prices are as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.55c to 1.65c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

OLD MATERIAL.—There has been considerable figuring on old rails in the last week but no sales of any consequence have been made. Buyers as a rule are not willing to pay the prices asked by holders. The railroads which have old iron rails on hand are asking as high as $15 for them, while most consumers consider $12.50 a fair price. One sale of 100 tons of old wheels was made last week at $10.50. Prices are made at $13 and $13.50 for old iron rails, $8.50 to $9 for old steel rails, and $10.50 to $10.75 for old wheels. Miscellaneous scrap is quoted about as follows: Railroad forge, $12 to $12.50; dealer's forge, $10 to $10.50; No. 1 mill, $7 to $7.50; heavy cast, net ton, $7.50 to $7.75; malleable cast, net ton, $8.50; axles, $14.25; cast borings, $3; wrought turnings, $4; axle turnings, $5.50 to $6; mixed steel, heavy, $7.50; stove plates, $5.50; heavy melting steel, $9.00 to $9.25.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, March 24.

One of the lots of billets inquired for last week was covered in Pittsburg, but so far none of the other companies have bought. The advance in asking prices on billets was but temporary, and prices are weaker again. Bessemer has shown no trace of activity, owing thus far, perhaps, to the unsettled ore situation, which from indications will soon be cleared up, but not in the way that has been expected up to this week. A quiet week is noted in all finished lines. Track material shows a healthy demand and spikes and splice bars are being rapidly booked. An order for 50 miles of wrought pipe is a feature of the week.

PIG IRON—The lack of consumptive demand for Bessemer and the continued talk of low prices are ascribed by some to be the results of another week of uncertainty regarding the new ore basis. The week has brought no sales nor inquiries, and talk of low prices is unabated. Offers of $10.40 Pittsburg, or $9.75 furnace, are reported from the valley and even this quotation is said to be shaded. Two furnaces in the Youngstown district have blown out during the week. An inquiry for 2,000 to 3,000 tons of gray forge breaks the long lack of demand in this line. Low prices continue on foundry iron and only a few small sales are reported. We quote, f. o. b. Pittsburg:

Bessemer	$10.40 to $10.65
No. 1 Foundry	11.00 to 11.25
No. 2 Foundry	10.25 to 10.50
No. 3 Foundry	10.00
Gray Forge	9.50

BILLETS.—A 6,000-ton sale of Pittsburg steel is reported and is the only transaction, so far, resulting from the inquiries of finishing mills which were on the market last week. The higher asking prices which resulted from the inquiries for steel found no basis for such an advance and nothing was done at the higher figures. Pittsburg and valley mills are said to be well booked and are maintaining prices above $15.50, Pittsburg. The billets now offered are in the main resales. Steel of this sort is said to have been offered at $15 in the valley during the week, and $15.25 and $15.50, Pittsburg, have been talked of. Inquiries of 2,000 and 3,000 tons are on the market, but there is no assurance that actual business is intended.

RAILROAD AND TRACK SUPPLIES.—The expected business in track material is on, spikes and splice bars being in heavy demand. On the former the capacity of one of the largest local mills is taken for two months ahead. Rails are quiet, no quotations being heard. We quote: Rails, $21; splice bars, 1.40c to 1.45c; track bolts, iron, 1.95c to 2c; steel spikes, 1.65c to 1.75c.

STRUCTURAL MATERIAL.—None of the large contracts pending were closed during the week. The Pittsburg visit of county commissioners from Detroit did not bring to an issue the matter of furnishing material for the court house there and the wrangle continues. Some new work is in sight, not as yet being bid on, but current business is not meeting expectations. We continue to quote: Beams and channels, 15-

inch and under, 1.55c; 20-inch, 1.70c; 24-inch, 1.75c; angles, 1.10c; universal plates, 1.10c to 1.15c; zees, 1.30c to 1.35c; tees, 1.35c to 1.40c.

PLATES.—Notwithstanding an apparent reaction from the record of recent weeks, business in sheared plates is of fair proportions and more work is in sight. We continue to quote: Tank, 1.10c to 1.20c; shell, 1.25c to 1.30c; flange, 1.35c to 1.40c.

BARS.—Mills willing to take steel bars at ruling prices are finding some new business and a fair amount of orders on contract. On such orders 1c is frequently shaded, although that figure is nominally held. Other mills refuse business below 1.05c—which virtually forces them out of the present market. Common bar iron is quoted by Pittsburg mills at 1.15c but no business at any price is going. On best muck bar 1.25c to 1.30c is quoted. Common valley iron is inactive at 1c to 1.05c, valley mill.

SHEETS.—Some little business in corrugating material is reported. Depressed prices on black sheets continue to an extent not acknowledged by mills. Stocks in middle hands are offered at figures lower than our quotations. We quote No. 26, 1.90c; No. 27, 2c; No. 28, 2.10c. On galvanized we quote 80 and five per cent off list.

WROUGHT PIPE.—An off week is reported in pipe of all kinds and a 10 per cent reduction of wages is announced by another pipe works. The requirement for 50 miles of gas pipe from Lafayette, Ind., aroused lively competition and some low bids were made. The order was taken by the American Tube & Iron Co. An order of special line pipe was also taken in the week, and likewise called forth warm competition. A halt is noted in sales of merchant pipe. We quote: Merchant pipe, 57 to 67 per cent; galvanized, 50 to 55 per cent; on car load lots, six tens; less than car load lots, five tens and five per cent. On merchant boiler tubes we quote: Two and a quarter inches and smaller, 70 and 10 per cent discount; two and a half inches and over, 75 and 5 per cent discount; casing, inserted joints, 57½ per cent discount; screw and socket joint, 62½ per cent discount.

IRON AND STEEL SKELP.—Both iron and steel skelp are weak. No demand for either is current. We continue to quote: Grooved steel skelp, .95c to 1c; sheared, 1.05c to 1.07½c; grooved iron skelp, 1.12½c to 1.15c; sheared iron skelp, 1.25c to 1.30c.

MERCHANT STEEL.—We continue to quote: Machinery steel, 1.30c to 1.35c, base; sleigh shoe, 1.30c to 1.35c; soft steel bars, 1.20c; machine straightened, tire, 1.30c to 1.40c; spring, 1.30c to 1.35c; open-hearth spring, 1.55c to 1.60c; toe calk, 1.45c to 1.55c; tool steel, common, 5c to 7c. Special brands, 10c and upwards.

OLD MATERIAL.—There are no indications of changing conditions. Prices nominally continue as follows: Wrought scrap, No. 1, $10.75 to $10.50; old iron rails, $13 to $13.50; old steel rails, $10.50 to $11; cast scrap, $10 to $10.25; hammered iron axles, $15.50 to $16, net; rolled iron axles, $13.75 to $14; machinery cast, $9.75 to $10; heavy melting stock, $12 to $12.50; coil spring, $10.50 to $11; leaf-springs, $13.25 to $13.50; car wheels, $10.25 to $10.50.

"LOCOMOTIVE Coaling Stations, Coal and Freight Handling Machinery," erected by the Link Belt Machinery Co., of Chicago, are illustrated in a 44-page calalogue just issued by that company. The illustrations comprise coaling stations built in 1895 at Wabash, Ind., for the C., C., C. & St. L. Ry.; at Croton, N. Y., for the N. Y. C. & H. R. R.R.; at New Buffalo, Mich., for the C. & W. M. Ry., together with those built at several other points for various companies. Several views of the same plants are shown giving an excellent idea as to the practical working of the machinery. In addition to these are illustrations of several endless freight carriers which have been built by the Link Belt Machinery Co. for loading and unloading vessels and for use in mills, factories and warehouses. The catalogue is very well printed and illustrated with excellent half-tone cuts, and is standard size, 6 by 9 inches.

AT Pittsburg, the court has overruled the report of the auditor in favor of giving the receiver's certificates preference.

SUPERIOR CHARCOAL IRON CO.

Negotiations which have been in progress for some time have resulted in the formation of the Superior Charcoal Iron Co., of Detroit, Mich. It is announced that from April 1 all business connected with the sale of the eight brands of Lake Superior charcoal iron named below, will be in the hands of this company: Antrim iron, of the Antrim Iron Co., Mancelona, Mich; Elk Rapids, of the Elk Rapids Iron Co., Elk Rapids, Mich.; Gaylord, of the Gaylord Iron Co., Detroit; Hinkle, of the Ashland Iron & Steel Co., Ashland, Wis.; Peninsular, of the Peninsular Iron Co., Detroit; Pioneer, of the Cleveland-Cliffs Iron Co., Gladstone, Mich.; Spring Lake, of the Spring Lake Iron Co., Fruitport, Mich.; Union, of the Union Iron Co., Detroit. The officers of the new company are: Wm. G. Mather, of Cleveland, president; W. H. Hinkle, of Ashland, vice-president; F. B. Gaylord, of Detroit, secretary and treasurer; J. C. Holt, of Mancelona, and Wm. Gerhauser, of Detroit, sales managers. The office will be at 66 Newberry Bldg., Detroit.

The producers of Lake Superior charcoal iron have had a good understanding as to prices for upwards of a year. This latest step means no change, therefore, in that respect. Nor does the formation of the Superior Charcoal Iron Co. work any change in the operations of the eight companies named, except that the new company does all the selling, in place of the producers, or those who have heretofore sold iron for them on commission, in connection with other irons. A chief aim of the new arrangement is to secure for the consumer just the iron best adapted to his needs. One particular furnace, by having ores and charcoal low in phosphorus, sulphur and silicon, will be best fitted to make iron filling such a specification. In another case a demand for a strong, high silicon iron may find a different furnace best prepared to fill the order. The intention is to have each furnace supply the iron it is best situated to produce, or on which its practice has secured best results. It is said to be part of the plan of the company, also, to pay more attention to analyses of irons, to their closer grading and to the furnishing of irons for all service rof which Salisbury, Southern and Swedish irons are used.

The eight companies named are all the producers of Lake Superior charcoal iron whose furnaces are now in blast, and it is not probable that the furnaces now out will resume at any early day. The increasing stocks of charcoal iron and the low state of the market indicate a consumption considerably below what the active furnaces could supply. Under these conditions, the arrangement to go into effect April 1 is considered opportune in its possibilities for enlarging the use of the Lake Superior charcoal product for car wheel, malleable, boiler tube, armor plate and other purposes. It is the expectation that the producers of these irons will not only maintain their position, but the purpose is to make such irons as will meet new wants and open up new fields.

ROBERT W. HUNT & Co., The Rookery, Chicago, have been given the inspection of the material and construction of 21 locomotives purchased by the Mexican Central Railway Co. from the Brooks Locomotive Works, Dunkirk, N. Y. This is the second locomotive order received by this firm from the above railroad, they having lately completed the inspection of 5 locomotives at the same works. Robert W. Hunt & Co. are also engaged upon the inspection of the material and construction of 50 cattle cars for the San Francisco & San Joaquin Valley Railway Co., and 180 freight cars for the Colorado Midland Railroad Co., both orders being at the Pullman Works.

THE Brightman Furnace Co. Cleveland, report several large stoker orders on hand, among them being five more for the Cleveland Water Works, making nine in all; one for the Buckeye Portland Cement Co., Bellefontaine, O.; one for the Langenau Mfg. Co., Cleveland, and two for Wm. Bailey & Son, Cleveland. The coming season promises increased stoker business and the company looks for its share. Catalogues, reports of evaporative tests and various other testimonials can be had by addressing the company.

THE IRON TRADE REVIEW

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MARCH 25, 1897.

THE END OF THE OLD IRON ORE POOL.

The meeting of the governing committee of the Bessemer Ore Association, in Cleveland on Monday, showed that obstacles to the continuation of the organization were insurmountable, and at the general meeting held on Tuesday the pool was formally dissolved. The result was different from what had been anticipated for three weeks. While at no time in that period was there any certainty of agreement, the disposition to make concessions for the purpose of saving a disruption seemed to guarantee that at length common ground would be reached.

In a general way it has been known that questions growing out of the lease of the Mountain Iron mine to the Carnegie-Oliver interests were a serious difficulty, but the refusal of the latter to accept any restriction was immediately the cause of dissolution. The bearing of the railroad situation on the Mesabi range upon the adjustment of allotments there has already been pointed out. The Minnesota Iron Co. considered some concession due it from the Rockefeller interest because of the large freightage the latter had secured by leasing the Mountain Iron mine while still a member of the pool. From the Rockefeller company concessions were forthcoming. It proposed to submit to sharp reductions of the product of its own mines; and it is stated that the company was willing to reduce the minimum on which royalty should be paid, in the case of the Carnegie properties, so that a limitation might be made on shipments from these mines. But the Carnegie Steel Co. took the position that it had done all it was willing to do, in having agreed in its contract with the Rockefeller company not to sell ore on the market, and it would accept no limitation of its output. At the outset, it had been the understanding that the Carnegie Steel Co. was favorable to a pool, but there appeared to be no proposition, at the last, on which it and the association committee could agree. It is reported that an allotment of 1,000,000 tons to the Mountain Iron and Oliver would have been agreed to by the other interests. It has been developed that the Carnegie Steel Co., while agreeing in its contract with the Rockefeller company not to sell ore on the market, reserved the right to trade its Mesabi ores for old-range ores, or to make conversion deals, furnishing the ore and taking pig iron. How much old-range ores or pig iron it can obtain in trades with furnacemen will depend, of course, on the extent of the inducements it can offer. With no restriction on the price of Mesabi ores, and with the Carnegie Steel Co.'s freight rates from mine to upper lake dock fixed at 80 cents and its lake freight no less than the average of the market, other Mesabi ores will come close to its basis, in open-market transactions. If the competition between the Minnesota Iron Co. and the Lake Superior Consolidated Iron Mines should extend to freight rates, any reduction below 80 cents would give an advantage to independent producers, without extending to the Carnegie-Oliver interest, since the latter is pledged to pay an unvarying total of $1.05 for rail freight and royalty.

It has developed, in connection with the dissolution of the old ore pool, that the deal for the Mountain Iron mine was only taken up after the Oliver Iron Mining Co., in which the Carnegie interest is five-sixths, had begun negotiations for the Mahoning mine of the Mahoning Ore Co., in the Hibbing district. The Oliver Iron Mining Co. had also taken an option on the Sheridan mine in the Hibbing district. It is explained that the prospect of another road getting this tonnage—namely, the Duluth, Mississippi & Northern, which is the only line reaching the Hibbing district—and the certainty that the Carnegie Steel Co. would acquire further property on the Mesabi range, led the Consolidated Co. to enter into the negotiations which ended in the lease of the Mountain Iron.

The most obvious effect of an open market on Mesabi ores and the low basis to which other ores must come in consequence, will be the lowest prices ever made for the latter. Mines that were pumped out under $4 ore will lie idle and many of the smaller properties will be unable to operate under the new scale of prices. If business reaches the proportions of some calculations, the ability of the larger producers to supply the demand may be taxed to such an extent that later in the year ore prices will naturally advance. This is the chief basis of any encouragement that can be extracted from the situation. It need not be said that wages in the Marquette district, which have been maintained pending the decision reached this week, and which are now above the scale in other districts, must stand a reduction. Vermilion range wages may be expected to go lower, and it will be an open question whether even the present level of wages at some Gogebic and Menominee mines, which is giving the men only a bare living, will be justified by the price of the product.

The Wednesday meeting of old-range Bessemer producers will be followed by another, not later than Tuesday, at which the committee appointed to submit a schedule of prices and allotments will report. The suppositious ore containing 63 units of iron, .040 phosphorus and 10 per cent moisture, which is made the base, is close to the Norrie analysis, therefore Norrie, under the new arrangement, would bring $2.65. This is 10 cents below the open price of Norrie in 1894, when there was no pool. In 1895, the first year of the pool, when the Mesabi was outside, Norrie brought $2.90. Franklin and Biwabik, the highest priced products of the Mesabi, brought $2.75 and $2.65 respectively. Other Mesabi Bessemer ores sold from $2.50 down to $2. This year, with Norrie at $2.65 and a 25 cent deferential maintained, on the average Mesabi ore, the latter would bring $2.40, scaling down to $2. The outlook for some Mesabi propositions, with 40 to 50 cent royalty, is certainly not promising.

Serious Accident at Edgar Thomson.

(By Telegraph.)

PITTSBURGH, March 25.—The engine operating the roughing rolls at Edgar Thomson "ran away" Wednesday night. One of the large fly-wheels burst, the parts flying into the blooming, rail and finishing departments. The rail mill is badly wrecked and the entire plant is disabled. One man was killed and several were injured.

Cambria Iron Co on the Mesabi.

The Cambria Iron Co., Johnstown, Pa,, has recently become a stockholder in the Mahoning Ore Co., operating the Mahoning mine at Hibbing, Minn. The company's old-range interest, the Penn group on the Menominee range, is well known. This is its first investment on the Mesabi.

THE owners of the business offered for sale in the advertisement on page 31, state that they are led to dispose of their interests because all have passed the period of active business life and have no young men in the concern who can take their places. The capital fully paid is $100,000. At the inventory in the spring of 1896, the net assets, above liabilities, were $142,000. The liabilities are $15,000.

THE DUQUESNE FURNACES OF THE CARNEGIE STEEL CO., LTD.

(With Supplements.)

The fame of the new blast furnaces at Duquesne, Pa.—the latest of the record-making plants with which the Carnegie interest has been outdoing itself in the past few years—has already gone far afield. Not only have they become a synonym at home for the acme of advance in furnace practice, but on the other side of the water they stand for the most revolutionary step yet taken in American pig iron making—though, since the 1890 visit of English furnacemen and steel metallurgists to the United States, such revolutions are received there with less credulity than was once the case. Since the first of these 500-ton furnaces was blown in, in June of last year, bits of information as to equipment and practice have been published from time to time, and more or less commotion has resulted from the discussion of the technical and commercial aspects of the enterprise. Everywhere these statements as to output, percentages of Mesabi ores employed, and the low costs commanded by the abundance of the automatic features of the plant, were taken to be significant of a further transition to a lower basis. No doubt was left when it developed, last December, that Duquesne was really to be the culmination of a series of strokes, beginning with large ownership of cheaply-won Mesabi ores, and including intermediately a moderate lake freight rate, free from severe fluctuation, and the advantages of railroad ownership, on the haul from lower lake docks to the furnaces. At home, and abroad, as well, it was conceded that Duquesne means an early movement of American steel to outer markets, and one destined to grow at length to imposing proportions.

But these phases of a question of very present interest to American steel makers are not the purpose of this article. A representative of *The Iron Trade Review* has been permitted to visit the plant at Duquesne, and with the aid of the illustrations which will be found on other pages, some idea will be conveyed, in what follows, of the extent of the innovations these furnaces embody in respect to methods and results. Viewed from the standpoint of engineering, of metallurgy or of commercial outcome, the Duquesne plant is an impressive object lesson in latest-day achievement. Twelve months and a few days before furnace No. 1 was blown in, the site was green with crops. Much of it was marshy land, a ravine cutting diagonally across the line in which the furnaces stand. Steam shovel excavation, carried on also through the night, with the aid of electric lamps, took off the surface to the level of low water in the Monongahela River. Then piles, with iron shoes, were driven to a depth of 35 feet to bed-rock underneath the present site of Furnaces 1 and 2 and the intermediate stoves. On the piles came a grillage of rails and then for a distance of 50 feet to the level of the furnace hearth tiles, is a solid block of cement. The foundation thus made for Furnaces 1 and 2 is about 350 feet long, with 72 feet width at the base and 42 feet width at the top. It required about 50,000 tons of cement. The foundations for Furnaces 3 and 4 were less expensive, no piling being necessary. The extent and solidity of the foundation work in every part of the plant are astonishing, no less than $500,000 having been spent in this way alone.

The entire enclosure at Duquesne takes in 100 acres, about 50 acres of which are taken up by the furnaces, power and other buildings, ore pit, bins, tracks, etc., and the reserve ground on which two additional furnaces can be placed if desired. The remaining 50 acres are steel works site and yards.

Ore Storage and Handling.

Perhaps no feature of the whole undertaking is more significant of the method and resources of the Carnegie Steel Co. than the mammoth ore pit, two views of which are given in our photographic reproductions. While 50,000 to 75,000 tons of ore in its stock yard would tax the capacity of the average furnace company, room is provided in this great excavation at Duquesne for the storage of 600,000 tons. If the yearly consumption of ore by the four furnaces is something like 1,500,000 tons, it will be seen that the stock yard will hold more than a five months' supply. Thus it will be possible to take the entire year's supply of ore direct from the vessel to the furnace yard, as the furnace stock piles would contain at the close of navigation sufficient ore to last to the spring opening.

The ore pit is 1,085 feet long, 226 feet wide and 26 feet deep. The bottom is concreted and the retaining walls of solid masonry are 12 feet wide at the base and five feet at the top. Between the pit or stock yard and the furnaces are the ore, coke and limestone bins, to which reference will be made below. The stock yard is spanned by three electric traveling bridges, manufactured by the Brown Hoisting & Conveying Machine Co., Cleveland. These bridges may be moved to command any portion of the stock yard. The carriages are driven by wire ropes, the drums, clutches, etc., being mounted on the bridge. Two 100-h. p. Elwell-Parker shunt motors are direct connected to the drums, permitting the operator to move the bridge, carriage and hoist at the same time. The view in Fig. 2 gives a sectional view of the ore bins to the right of the stock yards, with cars standing on the tracks above them. The level of these unloading tracks is 26 feet above that of the bucket cars into which the ore is discharged through the bin chutes. When ore is to be stored in the stock yard it is unloaded from the drop-bottom cars into the left-hand bins whose bottoms slope at a 45 degree angle toward the stock yard. From these bins it is withdrawn into buckets standing just inside the stock yard retaining wall. As a bucket is filled, it is picked up by the Brown hoisting and conveying apparatus mentioned above, raised to the carriage and conveyed over the proper pile. Here the bucket encounters a wire rope which releases a trigger, the bucket being thus completely and instantly overturned, so that the ore falls vertically without the miscellaneous spilling that accompanies a swinging bucket. The bucket is returned for reloading, another meantime having been filled from the bin.

When it is desired to remove ore from any part of the stock-yard for furnace consumption, a drag or scoop bucket is suspended from the trolley of the ore bridge and by proper manipulation of the trolley the bucket is dragged up the side of the pile until it is filled. The view in Fig. 6 shows a drag bucket in position to be drawn up the pile. The trolley conveys this bucket to the right-hand bin, in Fig. 2, and dumps the ore, which is withdrawn in due time into a furnace bucket. If it is desired to deposit the bucket of stock-yard ore in a bin at a distant part of the stock yard, it is dumped first into a drop bottom car on the tracks running over the bins and then taken to the proper place.

The Ore, Coke and Limestone Bins.

The system of bins from which ore, coke and limestone are withdrawn into buckets to feed the furnaces, stretches out over a line about 1,000 feet long, or practically co-extensive with the side of the ore pit. The bins are of steel, with the supporting beams 17 feet apart. The bin capacity for each furnace is about 2,400 tons of ore, 900 tons of coke and 550 tons of limestone. By proper labeling, the contents of each ore bin are known, and on the outside of the ore buckets are plainly marked the proportions of the various grades of ore that are to be withdrawn into each. For example, if there are eight components of the mixture, one bucket of the train of three which carry sufficient ore for a charge, may have four ores, the second three and the third one. The buckets containing more than one grade of ore are moved by locomotive from bin to bin, until the proper amount of each grade is secured. Each bucket sits upon a car provided with weighing scales, on the platform of which the bucket rests, so that as the material comes through the chutes the correct amount is weighed for the mixture then in use. The buckets are in reality cylindrical steel shells of five and one-half feet diameter made of three-eighths inch plates, the shell resting on a movable bell-shaped bottom. In the apex of the bell, a heavy forged steel stem is fixed, extending out above the top

of the bucket. The part played by the construction of the bucket bottom, in the operation of filling, is indicated later.

The Furnace Hoist.

Conspicuous in most of the views we give is the hoisting bridge to the furnace top, this, with the various ingenious devices connected with the construction at the top, making one of the most interesting features of the plant. The incline leading to the top of the furnace consists of steel trusswork, carrying two tracks. The carriage which conveys to the top the buckets containing stock is a four-wheel truck, to which a cable is secured. The cable passes over a pulley-wheel at the top and the other end is secured on the winding drum in the engine room. About the front axle of the truck a yoke is pivoted, from which hangs a bifurcated hook. This catches up the handle of the bucket to be hoisted. The ore buckets, each on its car, are brought to the bottom of the incline, in trains of three pushed by a locomotive. Each bucket is in turn picked off the car by the hoist carriage and conveyed to the furnace top, the contents dumped and the bucket returned to the car to be shoved out of the way for the next bucket to take its place underneath the incline. As the hoist carriage reaches the furnace top the front wheels enter a pair of shoes (15, Fig. 4), which are an extension of the incline track but are free to move vertically. They are suspended from one end of the lever 18, as shown in the same illustration.

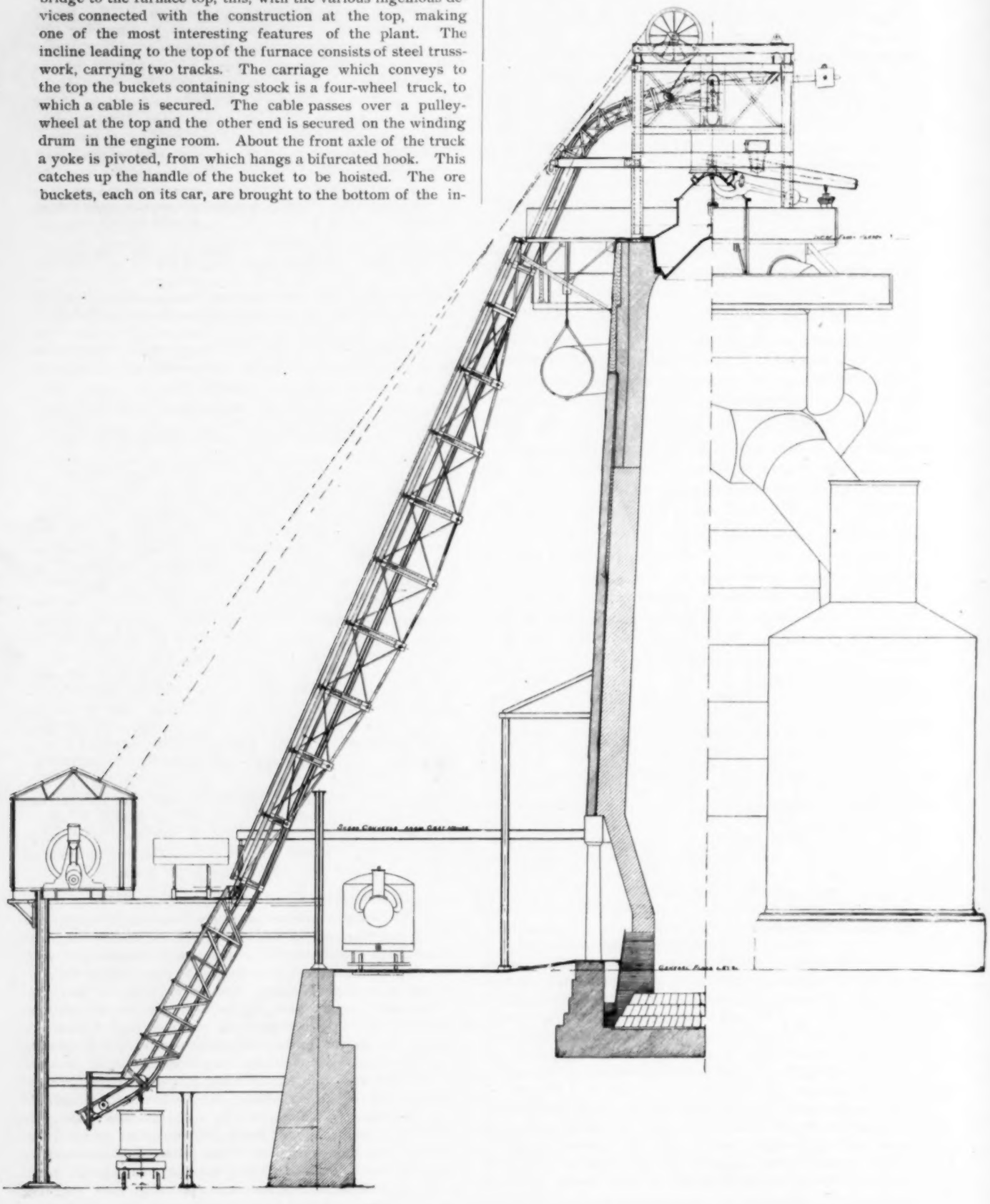

FIG. 3.—GENERAL ARRANGEMENT OF INCLINE AND CHARGING APPARATUS, WITH HALF-SECTIONAL VIEW OF FURNACE.

The other end of the lever is connected to the piston rod of the cylinder, 20. Compressed air is the motive power and

the cylinder valve is operated by the hoisting engineer. As the piston rod rises, the shoes, and with them the front axle and wheels of the carriage, together with the ore bucket, 13, are lowered until the lower flange of the bucket casing rests on the upper hopper. As the shoes continue to lower, the bell-shaped bottom of the bucket moves away from the casing, pushing the gas sealing bell, 34, down with it, and allowing the contents of the bucket to run out, the passage of the stock over the bell-shaped bottom distributing it uniformly over the main bell of the furnace. The absolute uniformity of this distribution has been demonstrated in experience.

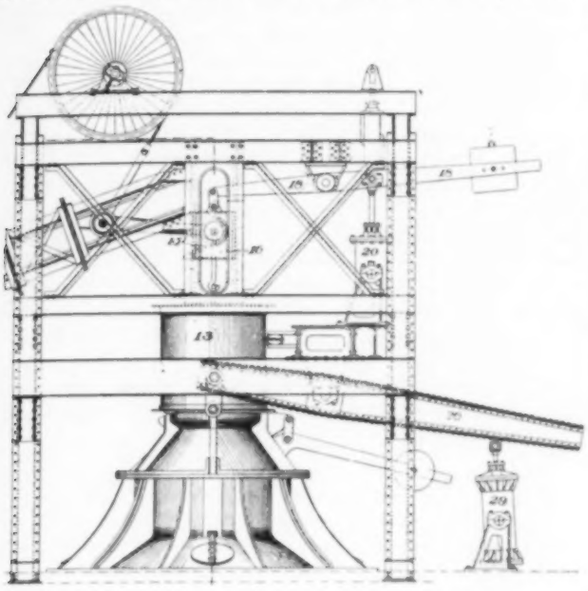

FIG. 4.—SIDE ELEVATION OF FURNACE TOP.

When the contents of three ore buckets, three coke buckets and one limestone bucket—or an average total of 41,000 lbs.—have been thus dropped on the main bell it is lowered by means of the lever 26. This is actuated, as is the gas seal lever, by compressed air, controlled also from the hoist operator's station, the pulling of a lever there admitting the air to the cylinder 29.

As the bottom of each bucket rises, after the dumping of its contents on the furnace bell, it picks up the shell, allowing the gas sealing bell to return to place. When the shoes reach their original position and register with the track rails of the incline, the hoisting drum is reversed, allowing the carriage and bucket to return down the incline. The bucket is replaced on its car and the hook is in position to pick up the next bucket as the locomotive pushes it in place.

The position of the bucket at the top, and of the main bell, in the operation of lowering, are made known to the operator by indicators in the hoist engine house. Crane reversing steam engines are employed for the hoisting operations, one 300 h. p. engine being provided for each furnace incline. Counter weights are provided weighing 45,000 lbs., their fall being about 40 feet, while the entire travel of the bucket is 156 feet. With a gearing of four to one, the counter-weight relieves the engine of practically half the rising load, which is composed of the 6,000-lb. bucket, the 4,000-lb. carriage and 10,000 to 11,000 lbs. of ore. Provision is made by which 40,000 lbs. of the descending counterweight is caught off on springs, as the carriage reaches the knuckle in the incline, near the top, where the angle of ascent changes to 20 degrees instead of 67 degrees. The carriage thus enters the shoe at the top without shock, or any violent change in the motion of the engine.

The hoisting arrangement was designed by M. A. Neeland, who is in charge of the draughting department at Duquesne. It is covered by patents.

Furnaces, Cast-House, and Mixer.

The furnaces are 97 feet high, 22 feet at the bosh, with a hearth diameter of 14 feet. The stoves are of like height—the Julian Kennedy type of two-pass stoves with central combustion chamber and independent stack. Hexagon-shaped brick are employed for the checker work.

Fig. 2 gives an external view of one of the cast houses. It is 200 feet in length. Through six runners at the side, as the metal is tapped out of the furnace, it is received into 30-ton ladle cars and taken to the mixer house, adjoining the Bessemer mill of the steel plant. The mixer is a huge affair, holding 250 tons of metal, and is built up of heavy steel plates. It is mounted on rollers, and motion is given it by means of a plunger underneath, with cylinder at either end, these being supplied with steam from a steel works accumulator. The shape of the mixer is that of a half cylinder, bulging at the sides, and drawn out at either end for the ready pouring in or pouring out of the metal. The heat of the metal is maintained by the burning of natural gas over the surface, air being blown in from one side and gas from the other. A 50-ton electric crane of special type, built by the Morgan Engineering Co., lifts the ladles 30 feet to the mouth of the mixer for the pouring.

Sunday metal is cast in pigs in the sand. Each cast house is equipped with two 10-ton, three-movement electric traveling cranes. These carry the pigs to the pig iron breaker. They are cast in 26-foot lengths, four abreast. The breaker, which is provided with a fly-wheel 4 feet in diameter, is fed from a long table, driven by a 30-h. p. Westinghouse motor. The apparatus can handle over 100 tons of pig iron an hour. For carrying away the scrap each cast-house is provided with a 5-ton conveyor. This is a carriage running the length of the cast-house and thence to the yards. The frame and track, as they emerge from the cast-house, are shown in Figs.

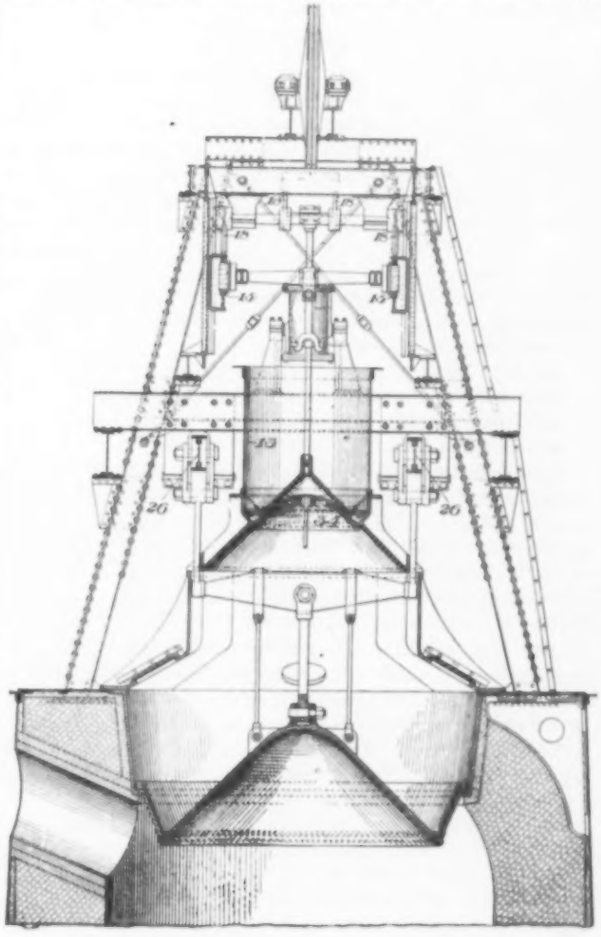

FIG. 5.—SECTIONAL VIEW OF FURNACE TOP.

3 and 7. The operator of the carriage of the scrap conveyor is protected from the heat of the pig bed by a shield of steel plates. Metal is tapped from the furnace five times in 24 hours. For closing the tap-hole, the Vaughn gun is employed.

The furnace operations are in charge of F. L. Grammar, who was appointed superintendent in February. The general superintendent of the Duquesne plants, who has been in charge during the important work of the past 18 months, is H. B. Miller.

Power Equipment.

Each of the four boiler houses contains 3,000 h. p. of Babcock & Wilcox boilers, this equipment furnishing steam for

one furnace. One attendant is sufficient for each plant under ordinary circumstances, gas being burned. In case the furnaces are out and coal is used to supply steam for other operations, provision is made for the automatic conveyance and feeding of fuel and for the removal of ashes. There will be a surplus of steam, with this outfit, and a 24-inch main is now being constructed to supplement the supply at the steel works.

The blowing engines are five in number for each pair of furnaces, four active and one in reserve. They are compound condensing and were built by E. P. Allis Co., Milwaukee. The high pressure cylinder is 40 inches, the low pressure cylinder 78 inches, with 60-inch stroke, and the blowing tubs 76 inches diameter. The air supply from each engine is 25,000 cubic feet per minute. The beams of the engines weigh 30 tons each and are placed intermediately. The flywheels weigh 40 tons each.

The pump-house contains four vertical pumps, manufactured by Wilson & Snyder, of Pittsburg. They have differential plungers and are operated by compound condensing flywheel engines, with Porter crank. Each pump supplies 5,000,000 gallons in 24 hours. The water tower is of riveted plates and is 120 feet high.

The electric power-house contains three 500-h. p. Westinghouse generators, driven by tandem compound condensing Buckeye engines, with Blake condenser. The electric plant, besides driving dynamos furnishes power to operate the three ore bridges, the cast-house cranes, the overhead cranes in the blowing-engine house, mixer-house, ladle-house, pump-house and electric plant.

Furnace Practice.

It has been the common understanding concerning the Duquesne furnaces, since ground was broken for them, that their construction was with special reference to the use of a liberal percentage of Mesabi ores. The difficulties attending the employment of these ores in large quantities have been frequently spoken of. The responsibility has been laid upon them of all hanging, slipping and top explosions that may fall to the lot of furnacemen working them. The experience of the management at Duquesne in the past six months has been free from the troubles mentioned, and the conclusion is that the equipment employed is well adapted to the use of Mesabi ores. For considerable periods, ore mixtures of which 75 per cent was contributed by that range have been worked without difficulty. Another point that is regarded as established by the work at Duquesne is that Mesabi ores are not disadvantageous in a high furnace.

The construction of the furnace down-comer has had special reference to giving larger area than heretofore for the passage of the large volume of gas generated under the present practice of fast driving. There are six branches from the top of the furnace to the bustle pipe which connects with the down-comer, instead of the single down-comer, as in most furnaces. This enlarged area reduces the velocity of the flow of gases and lessens greatly the amount of fine ore carried over by them. Accumulations of dust are prevented by increasing the angle of descent of the down-comer. In the case of Furnaces 1 and 2 this angle is 30 degrees, which was thought a sufficient increase. In Furnaces 3 and 4 the angle of inclination will be made 50 degrees, and the diameter of the down-comer will be six and a half feet.

In respect to tuyere area, while the Nos. 1 and 2 furnaces at Duquesne increased the eight tuyeres employed at Edgar Thomson to 10, Furnaces 3 and 4 will double the latter number, and on the first blowing out of Nos. 1 and 2, 20 tuyeres will be put in there also. In the evolution of American blast furnace practice in the past 12 or 15 years, the first marked departure was the large production, by Julian Kennedy, at Edgar Thomson. This was followed by the low-fuel-consumption regime initiated by Mr. Potter at South Chicago. But economy of fuel was attended by a reduction of output. Then came the campaign of large outputs, combined with low fuel consumption, in which Edgar Thomson, in Mr. Gayley's hands, was so conspicuous a leader. Again, in turn, the fuel problem has been made prominent and what may reasonably be regarded as well-nigh the limit has been attained. Now comes, with the operations at Duquesne, a new and astonishing world's record of output, without surrendering the ground gained as to fuel. To push still further for prodigious output through multiple tuyeres is the aim at the pair of Duquesne furnaces soon to be blown in. The possibilities of tonnage through this arrangement are as yet only a matter of estimate. The statement has been given currency that a doubling of production is expected. This is erroneous. It is well recognized that blast furnace output is much more than a matter of air.

At Furnaces 1 and 2, the air supply has been at an average rate of 38,000 cubic feet per minute as compared, we believe, with about 33,000 cubic feet per minute at Edgar Thomson. At Furnaces 3 and 4 an average of 50,000 cubic feet will probably be attained. It has been a feature of the practice at Duquesne, as at Edgar Thomson, to maintain the temperature of air blast at about 1,000 degrees, as compared with, say, 1,200 degrees to 1,300 degrees in average practice at valley and Pittsburg plants.

The history of other furnaces has been repeated at Duquesne. There were difficulties, and at the beginning some disappointment as to output, but later operations have been more than compensation in exceeding calculations. The best month's run was 17,182 tons; the best week showed 4,294 tons, or a daily average of 613 tons, and the best day's output was 690 tons. The average coke consumption for the above was 1,700 tons. There has been some variation in the percentage of Mesabi ores used. It is the present purpose to have Furnace No. 3 ready to go in blast about May 1. Furnace No. 4 will follow a month later. No. 4 will run on basic iron and hot metal will be taken to Homestead. For so much as is run into chills, the Uehling casting apparatus will be installed.

Economies.

The magnitude of the investment represented, and the evidences that the engineers in charge were absolutely unrestricted as to outlay, are impressed on the visitor at every turn. Still stronger is the impression that the entirely unprecedented tonnage and the automatic performance of so large a portion of the work have secured a distinct lowering of any cost heretofore attained. The scarcity of men about the furnaces and yards, contrasted with the great scale of the operations going on, is a constant surprise. The operator of the traveling bridge over the stock yard, the engineer of the locomotive that conveys the bucket cars through the bin yard to the foot of the hoist, and the hoisting engineer, who controls every operation connected with raising the stock and charging the furnace, are unassisted by manual labor, except the few laborers who attend to the loosening of ore on the sides of stock piles and the two men on each train who open the bin chutes and see that the buckets fill evenly. Keepers and cast house laborers are employed, of course, in the usual number required in connection with the taking of direct metal and, on Sunday, the preparation of the pig beds for casting in sand.

It would seem that Duquesne has not only established a world record below what is attainable elsewhere in the cost of Bessemer pig iron, but that whatever advance is made elsewhere will be along the lines there indicated.

THE board of managers of the Joint Traffic Association has made public a ruling fixing the rate of $1.15 per ton on sheet bars and tin plate bars from Cleveland and Lorain to Wheeling. The managers recommend the following rates on iron and steel rails, in car loads: From Lorain to Kinmount, Ont., $4.50; from Bessemer, Pa., to Kinmount, $4.80; from Johnstown to Kinmount, $4.40; from Lorain to Newmarket, $3.80 from Bessemer to Newmarket, $4; from Johnstown to Newmarket, $4.34; from Lorain to Aurora, Ont., $3.60; from Bessemer to Aurora, $3.60; from Lorain to Rockland, Me., $5.18; from Lorain to Gauley, W. Va.; from Lorain to Dunmore, Pa., $2.30 per ton.

GEORGE W. MCCLURE & SON, engineers, Carnegie Bldg., Pittsburg, have completed the construction of a regenerative furnace at Arnold Station, Pa., for the Chambers Glass Co. They have also put in a stove, with McClure & Amsler improvement, for the Shenango Valley Steel Co. It is 19 feet in diameter by 75 feet high. Two stoves for the Carrie Furnace Co. have been completed, each 19½ feet by 85 feet and four others are being raised 20 feet, which will make them also 85 feet high. Three stoves, 19 feet 6 inches by 75 feet, have just been completed by the same firm for King, Gilbert & Warner, of Columbus.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The Pittsburg Foundrymen's Association was "at home" to the foundrymen of Western Pennsylvania at its rooms in the Builders' Exchange, last Monday evening, March 22. It was the regular session of the association, and President Robert Taylor was in the chair. The call of Secretary Zimmers disclosed the presence of 82 members and visiting foundrymen, as follows:

D. J. Thomas and Chas. Bauer, Sterritt & Thomas; Geo. Rolling, Pittsburg Malleable Iron Co.; C. M. Corbit, Pittsburg Reduction Co.; Jno. McM. Porter, Porter Foundry & Machine Co.; F. F. Woods, Roessing Co.; Daniel Fox, Best, Fox & Co.; Jno C. Myers, Totten & Hogg Iron & Steel Foundry Co.; J. H. Crane, Standard Mfg. Co.; P. Fflaum, Fort Pitt Foundry & Refining Co.; Jno. McLaren, Phillips & McLaren; David L. Evans, C. W. Jones, Rosedale Foundry Co.; Wm. Yagle, Oliver Wylie, W. J. Naesser, Wm. Yagle & Co., Ltd.; Hunter Sleeth, S. D. Sleeth, C. F. Knowlton, Westinghouse Air Brake Co.; Robert Taylor, H. M. Wilson, Samuel Groves, J. H. Johnson, Taylor, Wilson & Co.; Chas. Weinder, B. F. Fuller, J. M. Clark, Jas. Boyle, Robt. McDonald, Jas. McDonald, J. R. Bockerman, W. A. Reed, Westinghouse Electric & Mfg. Co.; Chas. W. Friend, A. B. Harrison, Clinton Iron & Steel Co.; Samuel Robinson, J. A. Anderson, Robinson Machine Co., Monongahela City, Pa.; Jno. A. Meighan, Dawson Bros. & Meighan; W. J. Early, W. J. Early & Son; C. A. Stroh, Kinzer & Jones; R. B. Lean, Crescent Foundry & Construction Co.; David McClain, Pittsburg Steel Casting Co.; Richard Moldenke, John Pfeil, McConway & Torley Co.; Chas. Bailey, Reliance Steel Casting Co.; S. M. Rodgers, Hainsworth Steel Co.; Eliot A. Kebler, Matthew Addy & Co.; Howard M. Hooker, Rogers, Brown & Warner; William Bradbury, Lew A. Anzhutz, Frank Anzhutz, Anzhutz, Bradbury Co.; W. G. Harker, Knott, Harker & Co., Beaver Falls, Pa.; W. L. Dawes, Thos. Christian, Dawes & Myler, New Brighton, Pa.; J. S. McCormick, T. E. Malone, J. S. McCormick Co.; R. F. Barker, Pittsburg Mfg. Co.; Thos. D. West, Thos. D. West Foundry Co., Sharpsville, Pa.; B. E. V. Luty, *Tin and Terne;* Jas. R. Mills, Jr., *The Iron Trade Review;* John A. Penton, *Foundry*, Detroit; J. W. Frank, E. Kneeland, Frank-Kneeland Machine Co.; F. G. Smith, Hydraulic Machine Co; John A. Logan, Jones & Laughlins; F. Mecklin, U. S. Radiator Co., West Newton, Pa.; Phillip Mathes, Brittain, Graham & Mathes; J. R. Darragh, Isabella Furnace Co.; J. M. Ryan, Pittsburg Steel Casting Co.; Jas. Boyd, Standard Mfg. Co.; M. N. Cecil, Center Foundry, Wheeling, W. Va.; Jos. S. Seaman, M. Lloyd, H. C. Becker and W. Nichols, Seaman-Sleeth Co.; B. D. Northropp; F. H. Zimmers, Union Foundry & Machine Co.; James W. Miller, Uehling Casting & Conveying Co.; George Mesta, Leechburg Foundry & Machine Co.

Following the transaction of routine business, President Taylor welcomed the visiting foundrymen, explaining the purpose of the Pittsburg association, and throwing open the doors of active membership to all foundrymen. Letters of regret were read by the secretary from prominent authorities on foundry practice, all congratulating the Pittsburg association on the favorable showing already made. The regular program was then taken up.

Secretary Penton, of the American Foundrymen's Association, read a paper on "The Need of a Better Organization Among Foundrymen." Beginning with the first "strike" recorded in history—the complaint of the Children of Israel against the decree of their Egyptian oppressors that they must make bricks from straw furnished by themselves—the speaker traced the benefits that have since resulted from organization. English manufacturers, by organization, have secured control of the South American markets and forced the English Government to subsidize a steamship line to South America. He spoke of the benefits that might be derived if American foundrymen would work together in the same way and made a plea for the National Association. "There is only one man to whom such organization is unnecessary, and he is the man who knows it all. There may be an unusual number of such fortunate persons among foundrymen—men who have nothing to learn and fear some of the valuable exclusive information they possess might be absorbed by their rivals if they participated in such associations as these—but it is a very wise man who can learn nothing from his competitors."

Concluding, Mr. Penton dwelt on the necessity of banishing distrust among foundrymen and binding by social ties interests that otherwise would be antagonistic merely through misunderstanding.

Mr. William Bradbury, of the Anzhutz-Bradbury Co., and one of the oldest foundrymen in Pittsburg, followed in a reminiscent strain, noting the progress made since his first connection with a foundry, 41 years ago. He noted that the most rapid progress was made by progressive exchanging of ideas.

Thomas D. West concluded the formal speaking by urging the necessity of general participation in current discussions by all members, and offered many valuable suggestions. After a short recess supper was served in rooms under the association headquarters. Music was furnished by the Porritt-Miller Co. Mr. Penton, as toastmaster, struck a happy vein, and the responses were very entertaining. Vocal solos by Mr. T. E. Malone, of the J. S. McCormick Co., enlivened the toasts.

Twenty-three applications for membership were received, as follows:: S. M. Rodgers, Hainsworth Steel Works; B. D. Northropp, Washington, Pa.; S. D. Sleeth, Westinghouse Air Brake Co.; Jno. A. Penton, Detroit; A. Garrison Foundry Co.; Robinson Machine Co., Monongahela City, Pa.; Knott, Harker & Co., Beaver Falls; Keystone Coal & Coke Co.; Phillpis & McLaren, John A. Logan, Roessing Co.; Jno. R. Darragh, Isabella Furnace; David McLean, U. S. Radiator Co., West Newton, Pa.; Centre Foundry, Wheeling, W. Va.; C. A. Stroh, Kinzer & Jones; Thos. D. West, Thos. D. West Foundry Co.; Chas. Bailey, Reliance Steel Casting Co.; J. M. Ryan, Richard Moldenki, McConway & Torley Co.; Benj. D. Fuller, Westinghouse Electric & Mfg. Co.; Sterritt & Thomas, W. J. Early & Son.

An Interesting Coke Case.

The continuation of the hearing in the case of W. J. Rainey, the coke producer, against S. K. Wallace, receiver of the Jefferson Iron Works, of Steubenville, O., was concluded before Judge Douthitt, at New Philadelphia, O., last week, and his decision will be given at the next term of court. The first hearing was at Steubenville, and the case has attracted considerable attention from coke buyers. The question involved was the amount of phosphorus that might be contained in Connellsville coke intended for a furnace running on Bessemer pig iron.

Mr. Rainey was shipping coke to the Jefferson Iron Works It was alleged that the coke was for the manufacture of Bessemer pig iron, and that Rainey knew that coke for Bessemer pig iron should not contain more than .021 per cent of phosphorus, and that the coke was not to contain more. It was claimed that some of the coke sent Receiver Wallace contained phosphorus largely in excess of that amount, and that some was used in the furnace of the Jefferson Iron Works, making off iron, that Wallace was forced to sell at a discount.

Chemists were present who had analyzed the coke and who gave expert testimony. The analysis of the coke pile showed that it varied. W. J. Rattle, of Cleveland, on one occasion made the coke he analyzed contain .061 per cent of phosphorus. Mr. Couch after analyzing from samples taken from all over the pile found it to contain .051 per cent. Eminent legal talent was employed on both sides of the case, which was tried at the first hearing by a jury, but was taken from the jury by the judge, who claimed that a jury had no right to sit on a case in a suit against a receiver, who is an agent of the court.

THE Sharpsburg Bridge Co. has been chartered with a capital of $20,000, to build a bridge over the Allegheny River at Butler street, Pittsburg. Directors are: Gustave Kaufman, Albert L. Schultz, Pittsburg; Otto Schultz, McKee's Rocks; Edward Sapp, New Kensington; William Kaufman, Allegheny.

THE offices of the various interests now comprising the Oliver & Snyder Steel Co., of Pittsburg, have been consolidated and possession has been taken of the second floor in the German National Bank Building.

CHARTER GAS AND GASOLINE ENGINES.

In designing the Charter gas engine, sectional and outline views of which are given in the accompanying illustration, one of the aims has been to have the smallest possible number of parts outside of the base, cylinder, piston, connecting rod, crank shaft and fly wheel, which are essential to all engines. The other parts, as shown in Fig. 1 are the

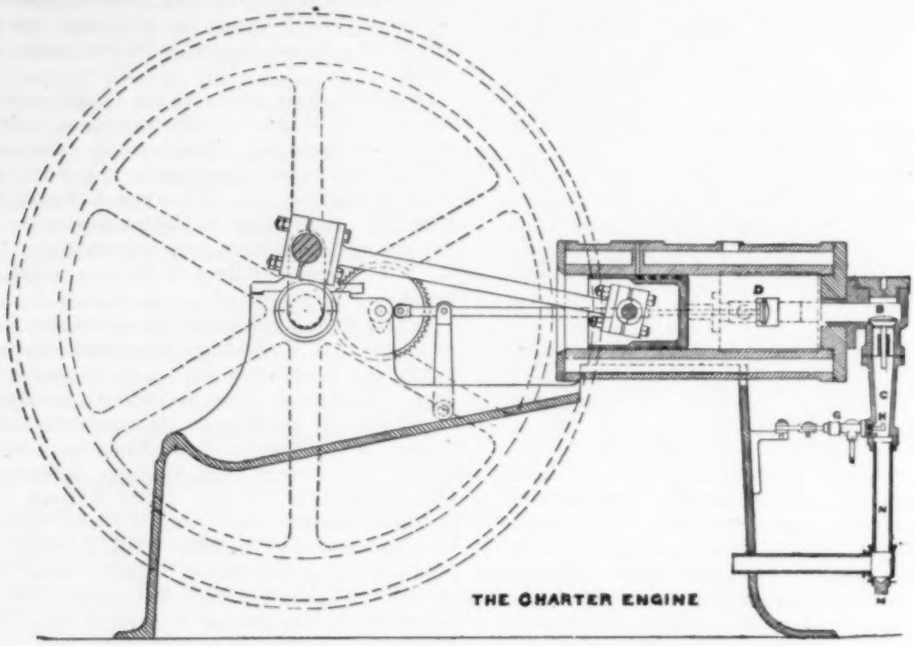

FIG. 1.

governor; a rod leading from the governor to the gas or gasoline valve G; the valve G, which prevents entrance of the fuel except when opened by the governor; the check valve B, which is raised by the suction of the piston; a pair of spur gears with cam and rod leading to the exhaust valve D, which is also a check. The air suction pipe N is run into the base to prevent picking up dirt and dust outside.

The development of power is as follows: On the first out-stroke of the piston a diluted mixture of gasoline and air or gas and air is drawn into the cylinder through a check-valve on the head of the cylinder. The check-valve opens during the suction stroke, and at the end it seats itself and is closed during the in-stroke of the piston. The mixture drawn into the cylinder is compressed into the space between the head of the cylinder and the piston during the in-stroke. The carbon of the mixture is ignited by a short metallic tube, closed at the outer end and communicating with the interior of the cylinder, enclosed by a chimney and heated by a Bunsen burner. The air being expanded by the heat evolved, an impulse is given to the piston. When the piston has reached its second out-stroke, the exhaust is opened and remains open during the second in-stroke of the piston and the products of combustion

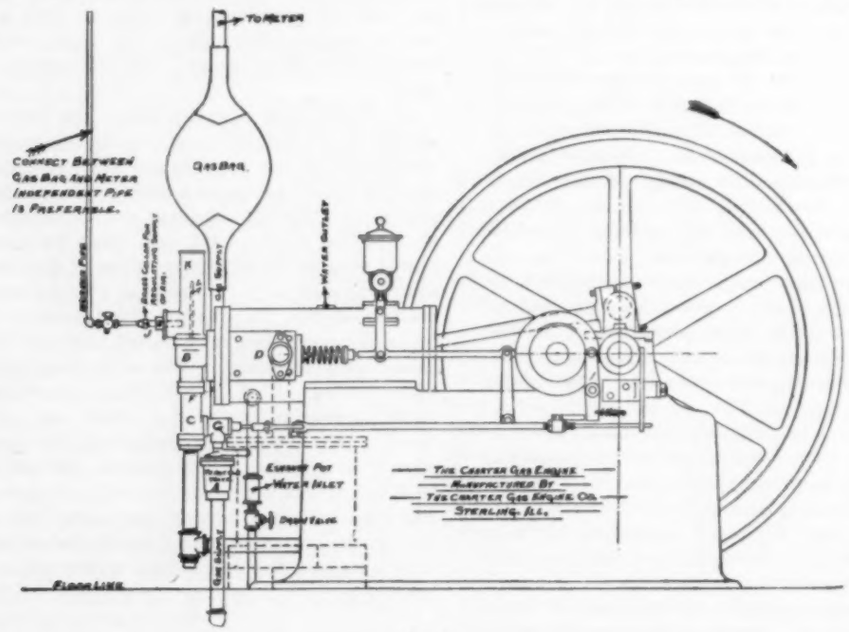
TO METER
GAS BAG
CONNECT BETWEEN GAS BAG AND METER INDEPENDENT PIPE IS PREFERABLE.
THE CHARTER GAS ENGINE MANUFACTURED BY THE CHARTER GAS ENGINE CO. STERLING, ILL.
FLOOR LINE

FIG. 2.

are expelled into the exhaust pot or muffler, and from it conducted to the outer air.

The governor gives only as much gasoline or gas, and at the desired time, as is needed to do the work. Thus the amount used depends on the work done. When less than full work is done only as many charges are admitted and ignited as are needed to keep up the regular speed of the engine. When this speed is slightly exceeded, the governor does not give gasoline or gas; but when the engine is working to its full capacity the governor gives a charge at every stroke. A heavy fly-wheel is calculated to give steady motion under part or full load.

When gasoline is used, it is taken direct from the tank into the air-suction pipe. After the gasoline is placed in the galvanized iron tank, which is tested to 150 lbs. pressure and is placed outside the building, it never comes in contact with the air, except inside the iron suction pipe N and the iron cylinder of the engine, to which it passes through the iron pipe, one charge at a time, consisting of a few drops. The gasoline is thus between iron walls from the time it is put into the

tank till it is exhausted into space through an iron pipe from the cylinder, where its heat-producing carbon has been consumed.

There are four cut-offs between the tank and the cylinder, viz., the valve below the tank, shown in Fig. 3, the valve below the throttle A; the throttle A, only opened to regulate the amount of gasoline delivered; and the plunger G (controlled by the governor) which withdraws and allows gasoline to enter air-suction pipe N through the nozzle H, and through which it is dragged into the cylinder by the violent current of air induced by the receding piston. The governor only withdraws the plunger G when the piston is creating a suction to take the gasoline up and into the cylinder. That there is no danger in the use of an elevated tank connected direct with the air-suction pipe N is evidenced by the fact that with Charter engines in use ten or a less number of years, there has not been an instance of fire or explosion.

The manufacturers are the Charter Gas Engine Co., Sterling, Ill.

REFERRING to operations at the Queen Iron Mining Co.'s properties at Negaunee, Ishpeming *Iron Ore* says: The territory added in the acquiring of the majority of the stock in the Blue mine is an important one. It gives the company 1,640 feet of land to the west, in which direction their ore is pitching, and being directly in the valley holding the mineral.

NATIONAL FOUNDRYMEN'S CONVENTION.

In a circular announcing that arrangements are now under way for the annual convention of the American Foundrymen's Association, to be held at Detroit the second week in May, Secretary Penton says that at that time the work of organization will be completed. At present the association has a membership of 500. Of the plans on foot for undertaking some definite work, and of the arrangements for the May convention, the circular says:

"A committee consisting of W. H. Pfahler, of the Abram Cox Stove Co., Philadelphia; Wm. Yagle, of Wm. Yagle & Co., Pittsburg; E. H. Putnam, of the Chattanooga Plow Co., Chattanooga, Tenn., has been appointed to meet at some convenient point previous to the convention, and consider the advisability of formulating a plan for a defense association, to protect the employing foundrymen from the annoyance, inconvenience and expense caused by labor difficulties, as has been so successfully done by the stove manufacturers of the country. Another committee consisting of C. S. Bell, of C. S. Bell Co., Hillsboro, O.; R. Viall, of Brown & Sharpe Mfg. Co., Providence, R. I., and Wm. Ferguson, of the Gates Iron Works, Chicago, has been appointed to take similar action regarding the preparation of and submission to the convention of a universal apprenticeship system that would be acceptable to the foundrymen of the country and contain special provision for the different branches of the business, such as agricultural, machinery, stove molding, etc., in order that a superior grade of American mechanics can be assured. These and many other matters will receive consideration at the convention, which it is expected will be one of the largest of its kind ever held.

"Committees are now busy arranging for the entertainment of all who attend and special rates will be secured on all railroad and steamboat lines and at the leading hotels, of which full particulars will be sent later."

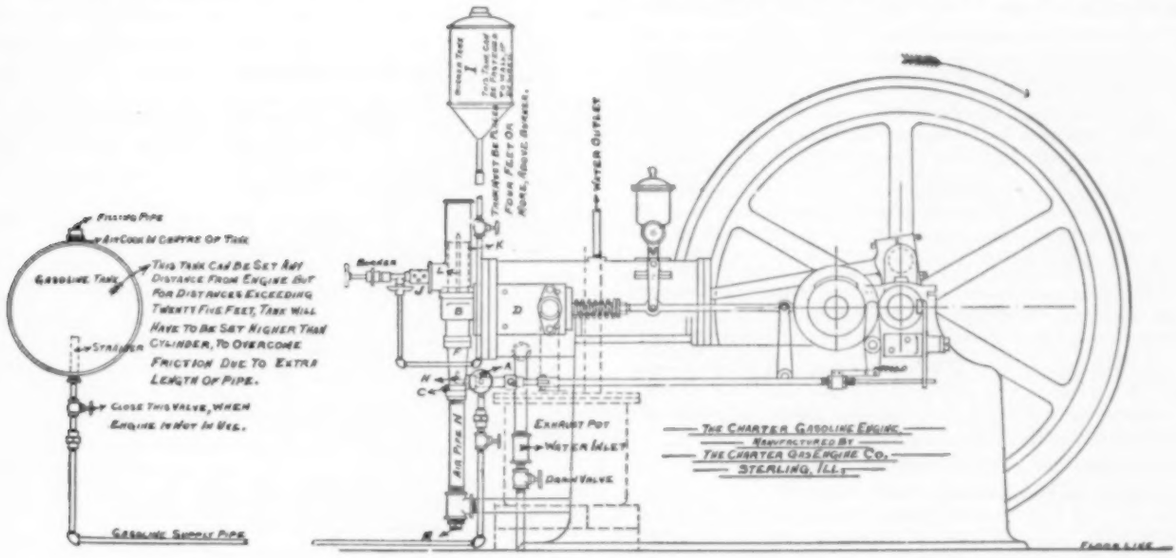
Filling Pipe
Air Cock in Centre of Tank
Gasoline Tank
This Tank Can Be Set Any Distance From Engine But For Distances Exceeding Twenty Five Feet, Tank Will Have To Be Set Higher Than Cylinder, To Overcome Friction Due To Extra Length Of Pipe.
Strainer
Close This Valve, When Engine Is Not In Use.
Gasoline Supply Pipe
Water Outlet
Exhaust Pipe
Water Inlet
Drain Valve
The Charter Gasoline Engine
Manufactured By
The Charter Gas Engine Co.
Sterling, Ill.

FIG. 3.

The Blue deposit has been opened on its trend for 320 feet east of the Queen's west line. The lowest level in this property is 460 feet from surface, and the shaft has been extended 80 feet below this. The purchase of stock was effected about the first of the year 1897. The mines of the Queen company would be able to produce 600,000 tons annually could a market at fair price be found for the product. All the different branches are looking well. Nothing is being done at the Buffalo or Prince of Wales, but these are in shape to be added at a day's notice. The mines are thoroughly ventilated, have many places of egress, are safe, and are well equipped with machinery. Nothing has been added in the latter line for some time past, it not being needed. The underground development at the properties of the Queen and the Blue gives great encouragement for added discoveries in the same valley.

THE Board of United States Engineers appointed by the Secretary of War, to take testimony regarding the alteration of certain bridges over the Monongahela and Ohio rivers, so as to widen channel spans, met in Pittsburg last week and heard arguments from river men and railway and city officials. The proposed changes involve a practical rebuilding of the B. & O. bridge at Bellaire, the Panhandle bridge at Steubenville, and a Monongahela river bridge owned by the city of Pittsburg.

GENERAL Manager Thomas C. Du Pont, of the Johnson Co., Johnstown, Pa., has sailed for a European trip.

Obituary.

P. A. Ahl, ex-president of the Harrisburg & Potomac Railroad, now the Philadelphia & Reading, and who formerly owned and operated the Boiling Springs Iron Co., died last Sunday, at Newville, Pa., aged 80 years.

John Thomas, of Allentown, Pa., died March 20, aged 68. During his active business life he was connected with the Crane Iron Works, Catasauqua Mfg. Co., and was a director of the Upper Lehigh Coal Co.

THE National Tube Works Co. has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable April 1.

NAYLOR & Co., New York and Pittsburg, have taken the selling agency for the by-product coke of the Pittsburg Gas & Coke Co.'s Otto-Hoffman by-product at plant Glassport, Pa.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Western Foundrymens' Association was held Wednesday evening, March 17, at the Great Northern Hotel, Chicago, the president, Mr. A. W. McArthur, in the chair.

Those present were the following: A. W. McArthur, Rockford Foundry Co., Rockford, Ill.; C. A. Sercomb, Schwab & Sercomb, Milwaukee, Wis.; S. T. Johnston, Whiting Foundry Equipment Co., John M. Sweeney, Harvey, Ill.; A. J. Roeffs, Appleton Mfg.Co., Batavia, Ill.; Max. H. Wickhorst, C., B. & Q. Brass Foundry, Aurora, Ill.; Geo. L. Roby, Gale Mfg. Co., Albion, Mich.; A. Sorge, Jr., consulting engineer; H. S. Vrooman, Garden City Sand Co.; A. D. Evans, Forster, Waterbury & Co.; C. O. Billow National Supply Co.; A. M. Thompson, Link Belt Machinery Co.; H. Wright, Frank Wright, Sargent Co.; Wm. Ferguson, H. C. Loudenbeck, Gates Iron Works; H. F. Frohman, S. Obermayer Co.; F. G. Coffeen, Deering Harvester Co.; E. W. Smith, Crane Co.; B. M. Gardner, *The Iron Trade Review*, Henry W. Carter; R. J. Cleveland, Cleveland & Barr; all of Chicago.

The following report was received from the Committee on Apprentices:

Supplementary Report of Committee on Apprentices.

In considering the suggested amendment relative to the propriety of providing some special inducement for young men having graduated from a manual training school, to take up the trade of iron molding and founding, we believe the desired end can be best accomplished by making a separate indenture for this class, believing such graduates will make the most desirable mechanics, and that their preparatory training will have given them such knowledge of the business that it will not take them as long to learn as the boy with a common school education. We would, therefore, advise a shorter term for these young men in each class, with a modification of the duties. We would also advise a more liberal compensation as an extra inducement. We do this on account of the fact that young men who have passed through manual training schools are better developed and of course have greater earning capacities than those entering the trade who are for years their juniors. This fact coupled with their better training and higher education, make them entitled to higher compensation.

We submit for your consideration the following indenture for this class of applicants:

INDENTURE FOR MANUAL TRAINING SCHOOL GRADUATES.

This agreement entered into this.....day of.....189..., between.....a firm or corporation organized under the laws of the State of....., party of the first part, and.....a manual training school graduate, party of the second part,

WITNESSETH: That the said party of the first part agrees to take said.....party of the second part into its employ and service for the period of three (3) years from the date hereof for the purpose of learning the trade of iron molder as carried on in its works; and, that the said party of the second part shall truly and faithfully work and serve for said period in such capacities as the foreman may from time to time direct; and that he shall obey all rules and regulations of the works; and the party of the second part also agrees to abstain from the use of intoxicating liquors during the term of apprenticeship.

The duties of the apprentice are defined as follows, but may be deviated from so long as it does not impair the apprentice's opportunity to learn the trade thoroughly: First three months of first year to be spent at taking care and charging of cupola, also lining ladles; next six months in core room; the last three months to be spent at bench molding.

The second year is to be devoted entirely to molding, the apprentice to be advanced from the small and plainer work to the more difficult and larger, as fast as his capabilities will prove it is profitable to do so.

The third year is to be devoted to the most responsible work in the shop, either in dry or green sand, as the capabilities of the apprentice may justify; and should he desire to learn loam molding, it will be necessary for him to devote one further year to this special branch of the trade.

Compensation shall be as follows: First year, $6 per week; second year, $7 per week; third year, $8 per week, and fourth year, $10 per week.

We do not consider that a bonus for extra efficiency will do any good in this class, as the incentive that impels young men in this class to take up this line of work will be all the encouragement necessary, and for the same reason we do not consider it necessary to retain any portion of the wages.

Your, committee, also acting on the suggestion contained in Mr. Gates' letter, would earnestly advise the appointment of a standing committee by your association, whose duty shall consist in visiting such manual training schools as are within its jurisdiction, for the purpose of conferring with the faculty relative to the best methods of training boys to become interested in foundry work, and also to see that their equipment is adequate to assist in accomplishing the desired end, and for a mutual exchange of ideas and suggestions; said committee to report at each meeting of the association.

Referring to regular indentures in class No. 1, in defining the duties in the fourth year, your committee would now ask to have that changed so as to read "The full year to be spent on the best class of work in the shop, etc." Also, in the first year, so as to read, "Nine months of first year to be spent in core room, etc., and three months at cupola and lining ladles."

Terms in class No. 2 for manual training school graduates, we would advise as follows: First three months to be spent in taking care of patterns and to be generally handy; next three months at care and managment of cupola and lining ladles; two years following, at molding in all its details from the simplest to the most difficult work, and the apprentice to be advanced as rapidly as he proves himself competent. Compensation for the first six months to be $1 per day, and $1 per week increase for each year, for balance of apprenticeship, where day work is the rule, and where piece work prevails the same terms as in regular indenture.

While not wishing to discourage manual training school graduates who wish to take up work in class No. 3, we cannot imagine a case where a young man with such schooling would select this branch; but to provide for such we believe the present indenture entirely suitable and can suggest no changes. We would, however, strongly recommend that the requirements as to fitness of apprentice recommended in regular indenture shall also apply to these special apprentices.

WILLIAM FERGUSON,
G. H. CARVER,
A. M. THOMPSON.

The report was accepted and the committee discharged.

A committee of three, consisting of James Frake, H. W. Carter and William Ferguson, was appointed by the chair to revise the various reports of the Committee on Apprentices and to present to the association a final report giving accurately the legal form of indenture which it would be advisable to adopt in each class.

The application of George L. Roby, of Albion, Mich., was presented for associate membership, and upon motion, he was elected.

On motion, the association decided to reconsider its action on the proposed amendments which were acted upon at the last meeting. Action was postponed, however, until the next regular meeting, when the amendments will be a special order exclusive of any other business.

A paper on "Phosphor Bronze," by Max. H. Wickhorst, Aurora, Ill., was read. It will be found in another column.

In the reading of his paper, Mr. Wickhorst submitted the following specifications for ingot copper used by the Chicago, Burlington & Quincy Railroad Co.:

"1st. Copper will be bought in ingots. Each ingot must have the brand of the maker cast upon it.

"2nd. Each ingot must show shrinkage in the mold in cooling, as shown by the concave surface of the open side.

"3d. An analysis of the borings of an ingot, taken at random from a shipment, will be taken to represent the shipment, and must show the following chemical composition: Copper not less than 99.65 per cent, and must be free from sulphur.

"4th. A shipment failing any of these requirements will be rejected."

Discussion.

Mr. Sweeney: How much phosphorus is lost in remelting?

Mr. Wickhorst: There is very little phosphorus lost if the metal is well covered with charcoal.

Mr. Sorge: What is the effect of phosphorus on bronze in regard to shrinkage?

Mr. Wickhorst: Phosphor bronze shrinks very little. The reason for that is this: Phosphorus combines with the air and forms a gas. When the metal is poured into the mold, of course, there is more or less drawn off and forms the gas and you have a metal that is not very dense and does not shrink very much. If you substitute aluminum it would combine with the oxygen and form a scum and the metal would shrink very much more.

Mr. H. W. Carter: I would like to ask how high a percentage of copper you have been able to use in any metal and still have a hard casting?

Mr. Wickhorst: I have several times made castings of copper that contained only a very little phosphorus and they were perfectly sound.

Mr. Carter: What percentage would that show?

Mr. Wickhorst: Say you had pure copper—100 per cent—to begin with, you would have 99.5 per cent copper.

Mr. Carter: Is there any difficulty in making that kind of casting?

Mr. Wickhorst: I have not made many, but with those I have made, I have had no difficulty.

Mr. Carter: Do you make your copper with the hardener, such as you speak of?

Mr. Wickhorst: Yes, with the phosphor copper.

Mr. Carter: There has been a demand for pure copper castings in electrical work and there is one firm that is making quite a claim on what they call a pure copper casting. I have seen the casting in sections and the fracture does not seem to show any porosity at all.

Mr. Wickhorst: They do try to get that with silicon copper. I have never tried that at all.

Mr. Sweeney: How does the slight percentage of phosphorus affect copper as to its electrical properties?

Mr. Wickhorst: I do not know.

Mr. Ferguson: Does the porosity you speak of occur more readily in the heavier than the light castings? Some 25 years ago I had something to do with brass. I remember I had a large valve to make—250 lbs.— and in portions it would run to two inches in thickness. We used our ordinary mixture of brass that we used for bearings and boxes. The casting came out sound but when we cut off the face it was nothing but a mass of porosity. I reasoned at that time that it was because of its being cast in green sand, so we remelted it and cast it over again in dry sand, but with the same result. I added more tin to the mixture and the casting came out as sound as a bell.

Mr. Wickhorst: Larger castings would show the porosity more because it takes them longer to cool and any gas that does come off has a better chance to show itself. The higher the percentage of tin is the less tendency there would be to create gas. You can take this bronze with its occluded gas and by letting it absorb air it presses the gas out; then add phosphorus and you can get a good sound casting.

Mr. Sweeney: I would like to call attention to the fact that this paper emphasizes the value of chemistry in the foundry. The matter has been so largely discussed here that I do not think that we should let an opportunity slip to show the proof of the arguments we have made.

Mr. George L. Roby read a paper on "Steel Core," which is given on another page. This paper was followed by an informal discussion.

A vote of thanks was unanimously extended to Messrs. Wickhorst and Roby for their very valuable and interesting papers.

An English View of Our Iron Exports.

Referring in their weekly market review to the question of iron and steel exports, Rogers, Brown & Co. make the following observation and introduce a letter from an English firm dealing in iron and steel, which gives a different opinion from that generally expressed on this subject, on the other side:

"There has been a great deal of speculation in regard to export demand for iron, and what will be the probable results. At present the demoralization in prices of foreign brands and the high ocean freight rates have operated to nearly put a stop to it. One of the important metal firms in London gives its views of the situation in a private letter, and it may be interesting to learn the foreigners' ideas about the prospects for our success in the way of supplying the world with iron. We give the following extracts from their letter:

"'We have a great deal of confidence in the permanency of the movement. From our point of view it is not an unnatural movement. We have seen similar changes in the copper trade. We used to export copper to America. Then we bought largely ores, etc., for smelters' use in this country. Now we import wire bars, ingots and other refined sorts, and are already in negotiation for the importations of sheets, manufactured rods, etc. In iron and steel we used to sell America in early days sheets, hoops, rods, bars, etc., and we then sent you pig iron, spiegeleisen and steel bars. Now we are buying pig iron, steel billets, etc., from you, and what we have seen take place in copper over a series of years, we are now seeing take place in iron. We are not prophets, but if we live a few years longer, we shall not be surprised to find that you are free traders, and the working classes in this country agitating for protection to save themselves from being swamped by cheap American goods.

"'We think that your faulty financial legislation is a disease that is eating the life out of the commercial community on your side of the water. You may be a little better at one time, and a little worse at another, and the price of cereals and what not be good with you, but in the main, until you face the music and apply the remedies to put your finances on a stable basis you can have no prolonged or serious prosperity. Therefore, we do not believe in any serious rise in prices with you or any permanent improvement in your home trade, and therefore you will continue for time to come to have a large surplus of iron that you will be very glad to sell to Europe for cash at low prices.'"

The Largest Air Compressor in Canada.

The Canadian Rand Drill Co., has recently shipped to the Le Roi Mining Co., at Rossland, B. C., the largest air compressor which has ever been built in Canada. The engines of this compressor are of the Corliss type, compound condensing. The two steam cylinders are 22 and 40 inches in diameter, by 48-inch stroke, while the two air cylinders are 22 and 34 inches diameter; the crank shaft which drives the machine is 12 inches diameter; the fly-wheel 10 feet in diameter by 40-inch face. It took six flat cars to tranship this consignment, and it went forward in one solid train over the Northern Pacific road. This is the third air compressor of the Rand make that the Le Roi Mine is running. The capacity of the big machine is 40 drills; the mine at present is running about 28, all of the Rand Little Giant type. A telegram in reference to this compressor was received by the Canadian Rand Drill Co. after its installation, announcing that it had started perfectly and expressing the satisfaction of the mining company with "so magnificent a machine."

THE success of the operation of long distance electrical transmission may be gauged by the opinion expressed by a company operating such a plant. A letter regarding the operation of the Fresno, Cal., long distance transmission written to the General Electric Co. by Mr. John J. Seymour, president of the San Joaquin Electric Co., operating the San Joaquin River-Fresno transmission, is as follows: "It affords me great pleasure to write you regarding the successful operation of the long distance transmission plant installed for our company. The entire plant as furnished has been in actual practical operation for a period of several months. The 35 miles transmission has given us no trouble whatever. Our load at present consists of 145 arc lights and 5,000 incandescent lights and 410 h. p. in motors, the latter including 180 h. p. for the Sperry flour mill and 75 h. p. for the city pumping plant. All of the machinery doing this work has worked with perfect success from the start. The incandescent lights have most of them been newly wired in, thus enabling us to properly balance the load and the regulation has given no trouble whatever. During extensive tests it was impossible to find more than two volts variation between any lamps on the system. Lights so furnished seem to me to be better than incandescent lights usually furnished in San Francisco and other cities of the State."

A COLUMBUS dispatch says that Insurance Commissioner Matthews writes Richard F. Loper, general manager, that he will not relicense the Guarantors' Liability Indemnity Co., of Philadelphia. The grounds of the refusal are that the company's financial condition is not sufficient under the Ohio laws. He claims that adding $300,000 reported as subscribed surplus to the liabilities not only has the stated surplus of $301,744.50 disappeared, but the capital stock has been impaired more than 30 per cent.

IMPROVEMENTS aggregating $50,000 will be made on the Wisconsin Central Railroad ore docks at Ashland, Wis. This work, together with 20 miles of double track on the Duluth, Missabi & Northern, and short extensions of the Ishpeming & Lake Superior will comprise all the additions to be made this year by the iron ore roads.

PHOSPHOR BRONZE.*

Its Manufacture, Properties and Foundry Treatment.

BY MAX H. WICKHORST.

Bronze is an alloy of copper and tin. Phosphor bronze is bronze containing varying amounts of phosphorus from a few hundredths of one per cent to 1 or 2 per cent. Copper is a soft, ductile metal. Tin is also a soft metal. But by adding a little tin to copper, we harden it. By increasing the amount of tin we make the alloy still harder. When about one part of tin has been added to two parts of copper, we have an alloy that is very hard and brittle. When more tin is added the metal begins to soften again.

Bronze containing simply copper and tin is very liable to be defective from the presence of oxygen, sulphur or occluded gases. Oxygen causes the metal to be spongy and weak. Sulphur causes porosity. Occluded gases cause porosity. Oxygen gets into the metal by absorption from the air. It can be eliminated by adding to the metal something which combines with the oxygen and then fluxes off. Such deoxidizers are zinc, antimony, aluminum, manganese, silicon and phosphorus. Sulphur and occluded gases can be eliminated by melting the metal, exposing it to the air and letting it thus absorb some oxygen which then burns the sulphur and gas. The oxygen can then be removed by adding one of the above mentioned deoxidizers. The important use of phosphorus in bronze is therefore to remove oxygen and also indirectly to destroy occluded gas and sulphur.

At the C. B. & Q. R. R. brass foundry at Aurora, Ill., we make a bronze with an extra high percentage of phosphorus, namely 6 per cent. We make this alloy so as to have phosphorus in convenient form for use, and the process of manufacture followed by us is as follows:

Ninety pounds of copper are melted under charcoal in a No. 70 crucible, which holds about 200 pounds of metal when full; 11 pounds of tin are added, and the metal is allowed to become hot. The crucible is then removed from the furnace, set upon the floor, and 7 pounds of phosphorus are introduced. The

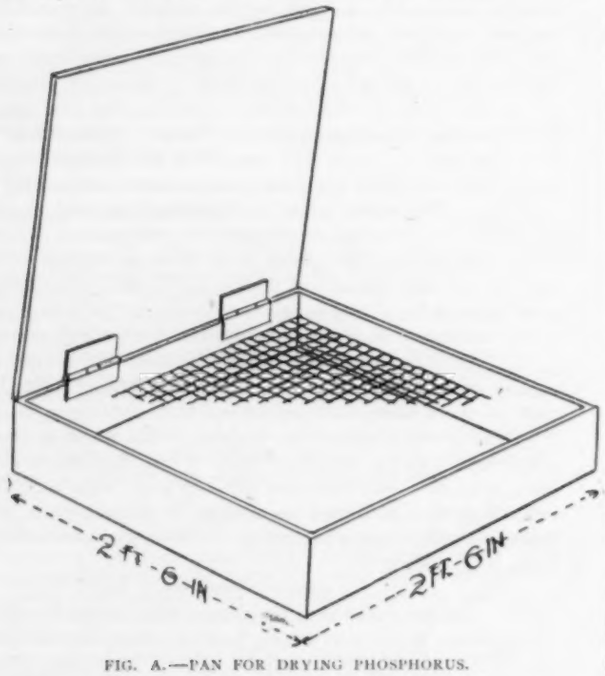

FIG. A.—PAN FOR DRYING PHOSPHORUS.

method of adding the phosphorus is as follows: A 3-gallon stone jar, half full of dilute solution of blue vitriol is weighed. Then the weights are increased 7 pounds, and phosphorus in sticks about 4 inches long is added till the scales balance again. The phosphorus is left in this solution half an hour or longer. By this means the phosphorus is given a coating of copper, so that it may be dried and exposed to the air without igniting. We have ready a pan (Fig. A) about 30 inches square and 6 inches deep, containing about 2 inches of water. Over the water is a wire netting which is laid loose on ledges or supports along the inner sides of the pan. On the netting is blotting paper, and on this the phosphorus is laid when taken out of the blue vitriol solution. The phosphorus is put on the blotting paper to dry. The pan also has a lid which can be put down in case of ignition of the phosphorus.

We now have the phosphorus ready for introduction into the metal. This is done by means of a cup-shaped instrument called a retort, or phosphorizer. Its shape is shown in Fig. B.

Having the molten metal ready on the ground, one man holds the retort on the rim of the crucible in a horizontal position, as shown in Fig. B. A second man takes about three

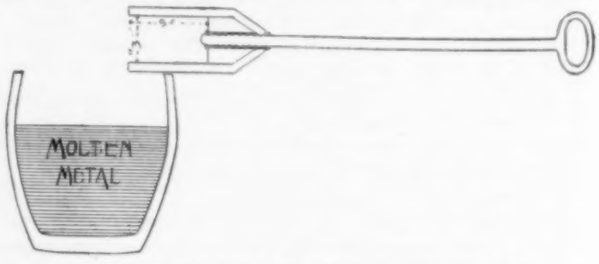

FIG. B.—RETORT AND CRUCIBLE FOR PHOSPHORIZING.
The space between the iron rod and retort is made tight with a cement of mineral paint mixed to a stiff paste with linseed oil.

pieces of phosphorus and throws them into the retort. The first man then immediately plunges the mouth of the retort below the surface of the metal before the phosphorus has a chance to fall or flow out. Of course, the phosphorus immediately melts and also begins to volatilize. As the phosphorus comes in contact with the metal it combines with it. This process is continued till all the 7 pounds of phosphorus has been put into the metal. The metal is then poured into slabs about 3 x 4 x 1 inch thick. The metal is so hard that a greater thickness would make it difficult to break it up. When finished, the metal contains, by analysis, 6 per cent of phosphorus. When we wish ordinarily to add phosphorus to metal we do it by adding a little of this hardener.

I will now discuss the properties of copper and the various bronzes. Copper is a soft, ductile metal with its melting point at about 2,000 degrees F., or 1,100 degrees C. Molten copper has the marked property of absorbing various gases. It is for this reason that it is so difficult to make sound castings of clear copper. Molten copper combines readily with the oxygen of the air, forming oxide of copper which dissolves in the copper and mixes homogeneously with it. This explains why melted copper has a clean surface, free from all scum; that is, as the air acts upon the copper, the oxide formed dissolves in the rest of the metal, leaving the surface clean. A casting made from such metal would be very spongy. The bad effect of oxygen is intended to be overcome by adding zinc to the extent of 1 per cent or more. This result can be much more effectively attained by the use of aluminum, manganese or phosphorus. The action of these substances is to combine with the oxygen, and as the product formed separates and goes to the surface, the metal is left in a sound condition. Aluminum and manganese deoxidize copper and bronze very effectively, and the oxide formed goes to the surface as a scum. When a casting is made from such metal, the oxide or scum, instead of freeing itself from the casting perfectly, generally remains in the top part of the casting mixed with the metal, as a fractured surface will show. Phosphorus deoxidizes copper and the oxide formed leaves the metal in the form of a gas or white smoke, and a casting made from such metal shows a clean fracture throughout, although the metal is not as dense as when aluminum or manganese is used.

Copper also has the property of absorbing or occluding coal gas or carbon monoxide. But the coal gas thus absorbed is in a different condition from the oxygen absorbed. When oxygen is absorbed by copper the oxygen combines chemically with the copper and loses its own identity as a gas and actually forms part of the solid. But when coal gas is absorbed by the copper, it keeps its own physical identity and simply exists in the copper in a state of solution. Just, for instance, as air and other gases dissolve in water. All natural waters, such as lake water, river water, spring water, etc., contain air in solution or occlusion. When such water is cooled and frozen, just at the time of changing from the liquid to the

* Read before the Western Foundrymen's Association, Chicago, March 17, 1897.

solid state, the dissolved gas separates and forms air bubbles, which remain entangled in the ice. And the coal gas which is dissolved or occluded in copper acts in exactly the same way. Suppose we cast some copper or bronze containing coal gas dissolved in it. While the metal is in the molten condition it is perfectly quiet, since the gas has no tendency to come out. We pour the metal into a mold of sand. The metal flows in all right. About two minutes or so after the metal has been all poured we notice that the gate begins to rise. This is because, just as the metal is setting the gas separates itself and assumes the gaseous form. Therefore, as this gas takes up more room it forces the metal out through the gate. After such a casting has been allowed to cool and all the sand has been cleaned off, the surface of the casting will be free from all signs of holes in the metal. But if we take a cold chisel and chip into the top side of the casting, or have the top skin machined off, the casting will be found to be all full of gas holes and, in fact, in a bad case the metal will be almost a sponge in appearance. The point I wish to emphasize is that one cannot tell whether a casting is porous by looking at the outside, since the gas which causes the porosity is evolved only after the skin has set, and therefore as the evolving gas rises to the surface of the casting it can get to the skin, but no farther.

Hydrogen acts in exactly the same manner as coal gas.

Sulphur also has a bad effect on copper and bronze in a similar manner to coal gas and hydrogen. Sulphur combines with copper and other metals, forming sulphide of copper, etc. When molten copper or bronze containing sulphur comes in contact with air it absorbs some oxygen and this in turn combines with the sulphur present, forming sulphur dioxide, which is a gas which remains occluded in the metal exactly the same as coal gas does and is liberated when the metal sets, also in the same way. If the metal is allowed to absorb more oxygen, the sulphur is oxidized to a higher oxide, which does not remain in the metal but goes off in fumes.

Tin is a soft white metal, melting at 440 degrees F. or 230 degrees C. Toward gases it acts something like copper, but not in so marked a degree. Although copper and tin are both soft, yet when mixed they make a harder metal. This is because copper and tin combine with each other chemically, to form a hard and very brittle substance. About two parts by weight of copper combine with one part of tin so that both substances are neutralized and there exists no free copper and no free tin, but the mixture consists entirely of the copper tin compound. Both the copper and tin have lost their own identity and no longer exist as such, but are chemically combined to form a compound which is very hard, brittle and gray in color. If more copper or tin is used than this, the two metals still form a chemical compound mixed with the excess of copper or tin, as the case may be. In bronze we have a copper tin compound, mixed with excess of copper, but we have no free tin. When bronze cools from the molten state, the copper and the copper tin compound tend to crystallize by themselves. The quicker the cooling occurs, the less separation will there be, and also the fracture will be more homogeneous in appearance.

When bronze contains occluded gas, it is probably the free copper entirely which occludes the gas. I judge this from the fact that in the fractured surface of some bronze defective from such gas, the gas cavities are mostly bright yellow in color, while the gray spots are compact.

Gun bronze contains copper and tin in the proportion of 9 or 10 parts of copper to 1 of tin. This is the metal used where an ordinary bronze casting is wanted. A harder bronze is copper and tin in the ratio of 6 to 1. This is often used as a bearing metal. When either of these metals is to be turned in the machine shop, they should contain about 3 per cent of lead, which will make them work very much better, but it also decreases their tensile strength. Bearing metal now generally contains about 10 per cent of lead, with copper and tin in varying ratios. The large percentage of lead is put in that the metal may wear away slower. Lead, although a metal having properties similar to tin, acts entirely different towards copper. Copper and tin have a good deal of affinity for each other, but copper and lead show no attraction at all for each other. Copper and tin mix in all proportions, but copper and lead mix only to a very limited extent. About 3 per cent of lead can be mixed with copper. With bronze 15 to 20 per cent of lead can be mixed. In bearing bronze, the lead keeps its own physical properties, so that the constituent lead melts long before the metal attains a red heat. It sometimes happens when a bearing runs warm, that the lead actually sweats out and forms pimples on the metal. Or sometimes in remelting a bearing bronze casting the lead may be seen to drop out while the metal is warming up.

All of these metals, however, should contain something to flux or deoxidize them, such as zinc, manganese, aluminum, silicon, antimony or phosphorus.

I will describe the method of preparing phosphor bronze bearing metal in vogue at Aurora. The metal made has the following composition:

Copper	79.7 per cent.
Tin	10. "
Lead	10. "
Phosphorus	0.3 "
	100.0

Melt 140 pounds of copper in a No. 70 pot, covering with charcoal. When copper is all melted add 17½ pounds of tin and 17½ pounds of lead and allow metal to become sufficiently warm, but not any hotter than it is needed. Then add 10 pounds of "hardener" (made as previously described) and stir well. Remove from furnace, skim off the charcoal, cool the metal with gates to as low a temperature as is consistent with getting a good casting, stir well again and pour. We face our molds for this kind of work with plumbago.

When good copper is used this procedure will always give a good sound bearing metal. However, as some kinds of copper on the market are very liable to contain sulphur or occluded gas, this kind of copper should be melted without covering, then exposed to the air to allow it to absorb oxygen, and thus oxidize out the sulphur and gas, stirring it well several times. Then add lead and tin, remove from furnace, add "hardener" and stir well. The idea is to allow the metal to absorb some oxygen, which removes the sulphur and occluded gas, and then to remove the excess of oxygen by adding phosphorus. As we buy copper on chemical specifications which insure good copper, I have had very little experience with poor copper.

There are several firms that make phosphor bronze bearings with a composition similar to the above one, and most of them, or perhaps all, make it by melting the metals and then charging with phosphorus to the extent of 0.7 to 1.0 per cent. But I have found some metal from all brands that I have tried that contains occluded gas. So that after such metal is cast, in about two minutes or so the metal will ooze or sweat out through the gate, and such a casting will be found to be porous. But I have not yet had one such experience with metal made as I have described above. My explanation of metal made by adding phosphorus direct to the final mixture containing occluded gas would be this: The phosphorus, as it is charged into the metal still contains a little moisture, and at the high temperature of the molten metal, the phosphorus takes the oxygen from this water, leaving the hydrogen to be absorbed by the metal. Whether this theory is correct or not, I cannot say from any experiments I have made. I merely offer it as a suggestion.

But this practical point should be heeded, viz.: That pig phosphor bronze should be bought to the specifications, that the metal should have shrunk in the ingot mold in cooling, as shown by the concave surface of the upper side, and that it should make a casting in a sand mold without rising in the gate after being poured.

In bearing metal, occluded gas is very objectionable because the gas in trying to free itself shoves the very hard copper-tin compound (which has a low melting point and remains liquid after the copper has begun to set) into spots, and thus causes hard spots in the metal.

Phosphorus is very dangerous stuff to handle and there is great risk from fire with it, so that many would not care to handle the phosphorus itself. But phosphor copper containing 5 per cent of phosphorus, and phosphor tin containing 2 to 7 per cent of phosphorus and several other such alloys can be obtained in the market. And I would suggest to those who wish to make phosphor bronze, but do not want to handle phosphorus itself, to make it by using the proper amount of

one of these high phosphorus alloys. In using phosphorus it is only necessary to use enough to thoroughly deoxidize the metal, say 0.3 per cent. More than this will make the metal harder but not any sounder.

STEEL CORES.*

BY GEO. L. ROBY, OF ALBION, MICH.

The formation of smooth and approximately accurate holes in iron or brass castings always involves trouble and expense. The method proposed is to substitute when possible a little extra attention and labor in the foundry for the wear of machine tools, supplies, power and labor of the machine shop. Broadly speaking the improvement suggested is to insert steel cores of the shape and size of the shaft or bar which the hole is to fit in the mold and afterwards remove them from the casting. This has been done in many foundries for years. But, except for special work, the objections of having to make tapering cores so that they may be removable and that the crystallization and chilling of the iron makes it difficult if not impossible to do any further work on a casting that cannot be brought to the emery wheel, have prevented the general use of steel cores.

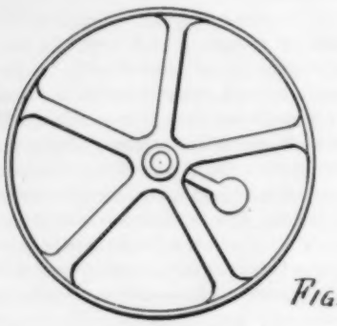

FIG. 1.

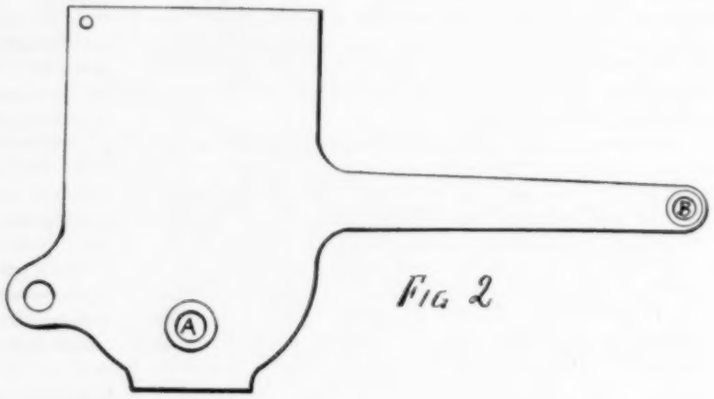

FIG. 2.

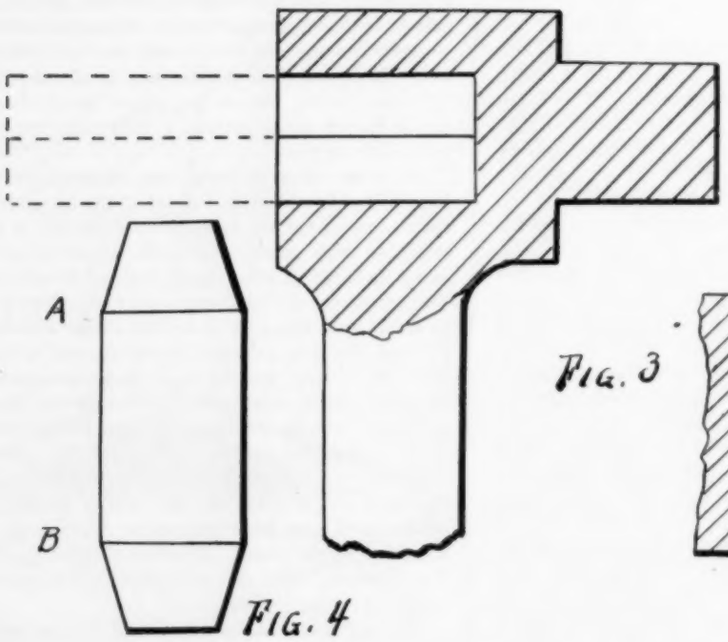

FIG. 4.

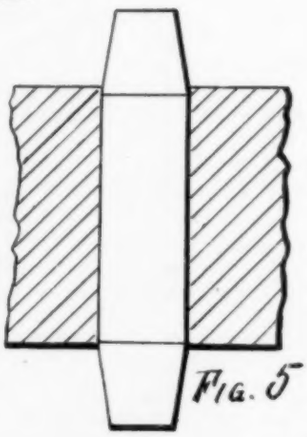

FIG. 3.

FIG. 5.

It will be admitted, however, that if these steel cores can be coated with a composition which will resist the heat and pressure of the melted iron, be non-conductive enough to prevent "chilling," so free from gas producing substances as to reduce the liability of "blowing" to a minimum, of a nature not antagonistic to the iron, and to which it will lay hard enough when placed upon the steel cores to bear ordinary handling, and yet after the casting has been made, to become so soft as to offer no resistance to its removal, the use of steel cores is capable of a greater adaptation to modern foundry work than it has yet been given. It is not asserted that a steel core will work in all places. It cannot compete with a sand core for producing a hole that is good enough as made with the sand core without drilling or reaming. It has been found impracticable to cast a thin shell around a large steel core, but a thinner shell can be cast around a steel core standing on end than lying down in the mold. A thinner shell can be cast around a well proportioned pattern that can be poured slowly than about one having thin webs.

To be on the safe side, it is best to assume that if the core is standing on end it will not give any trouble if the outside diameter is at least equal to twice the diameter of the core. If lying down, the core ought not to exceed ⅓ of the total diameter of the adjacent part of the casting. Like all rules, these can be broken with impunity if proper precautions are taken, and we know we are beyond the danger line. If the pattern can be gated so a considerable amount of metal may pass through the part having the steel core set, or if enough of the pattern projects above, so that the pressure of the iron will hold it up, much more difficult results may easily be achieved.

In a case where it was desired to cast a finished hole in a very light wheel 7 inches in diameter that was gated to the rim, a large percentage of the hubs were defective at the upper end. The wheel when gated as shown in Fig. 1 gave no further trouble, although the hub was less than ⅞ of an inch diameter and had a ½-inch hole, 2 inches long. These wheels went from the trimming room directly to the erecting shop. The usual cost in the machine shop being entirely saved, and better fitting journals secured than when drilled in jigs. Another case of finished work in this way was in making the castings for the frame of a small machine shown in Fig. 2. The two sides were joined so that if not set exact-

* Read before the Western Foundrymen's Association, Chicago, March 17, 1897.

ly right in the jigs the two sets of holes did not coincide. The shaft working in the bearings A and B were ½ inch and the bosses not ¾ inch at the end, the plates being about ⅛ inch thick. Prints were put in and steel cores used. No trouble was had in casting them and a more satisfactory job was done than when drilled, but extra care had to be taken to see that the flask pins were a tight fit and sometimes a long straight reamer was run through to line up the holes, but the iron not being chilled gave no more trouble than when drilled.

In Fig. 3 is shown a place where a sand core had been used. Great difficulty was found in getting the holes a satisfactory fit for the purpose desired. The steel cores were cut from the stock used. A perfectly finished hole was obtained at a less expense than with sand cores.

One of the greatest chances for money saving is casting gears, or pulleys that are afterwards to be turned up, the chucking and boring being dispensed with. The castings, direct from the foundry, can be driven on their mandrels and turned up. With care used to keep the mixture at the proper consistency the fit on the shaft will be as perfect as can be obtained. Irregular shaped holes, or cavities with smooth square bottom can be made with steel cores that can hardly be produced in any other way. Then again, on some light work too small to use sand cores at all, the steel core can be

Fig. 6.

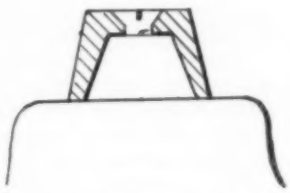

Fig. 7

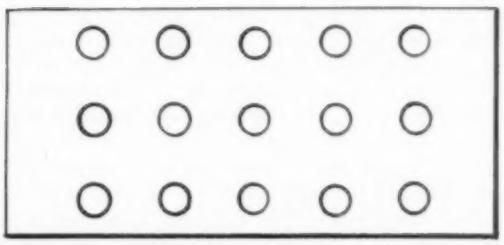

Fig. 8

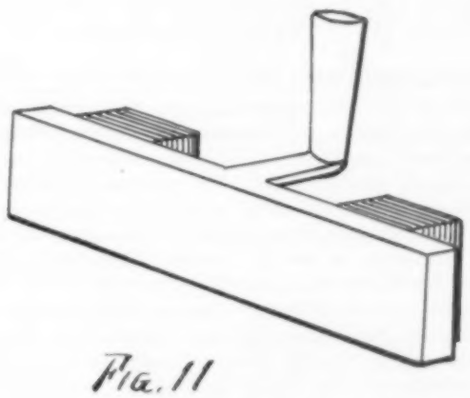

Fig. 11

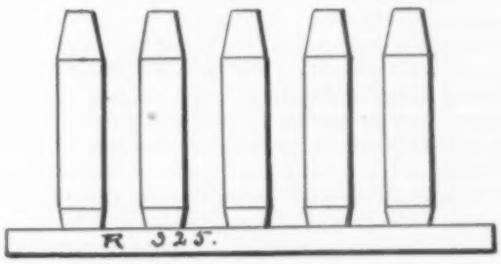

Fig. 9

used to great advantage and very small holes can be made. Taking cast butts, for instance, the holes for the pin can be cast in more cheaply and perfectly than they can be drilled even with automatic machinery. Set screen holes can be cored in, and having no sand in the holes the tap will last almost as long as drilled holes. Nuts for coarse threads can be made by placing a section of the screw in the mold, and every wide-awake superintendent who is not more firmly wedded to tradition than to the success and profit of his business will find many similar places for the saving of time and expense.

When lying horizontal in the flask the cores are of course only pieces of the stock that is expected to fit the hole cut off in the lathe or shaper with clean square ends; but when standing the usual taper for cope to close over is essential. It is also suggested that the distance from A to B in Fig. 4 should be a trifle longer than the distance through the casting, so that there will be no danger of "capping over." If steel cores properly coated do not come out easily, it is when there is no chance for this reason. Note Fig. 5. On old patterns having small prints it is found convenient to make the core like Fig. 6 and do satisfactory work for small runs, but it will usually be found to pay better to add enough to the print as in Fig. 7.

In doing jobbing work where but a few pieces are made, it is often much quicker and cheaper to make steel cores than to make a core box and sand cores, even when the latter would answer.

Heavy or larger cores ought to have a hole drilled in the end for handling when dipping. The composition should be kept in tightly closed vessels when not in use, as the liquid is very volatile. A small pail with a tight cover will answer nicely. It should be deep enough to take the largest core, and only about 5 or 6 inches in diameter to let the hands in the top when dipping small pieces. Drying board should be provided for cores used in any quantity, and as they are dipped, set in the holes. See Figs. 8 and 9. This board should then be delivered to the molder, and it should be made a part of his duty to see that they are taken from the castings and returned to the core room. The board, if neatly made and with a familiar number of holes makes a good check for preventing the loss of cores, and a convenient way to store in shelves when not in use. If the number or name of the casting is placed on the edge of the board it will add a still further convenience.

It must be remembered that a great deal depends upon the care with which the core is coated, and this should be entrusted to some employe who not only has an interest in the work, but a chance to see the results. If in proper condition the cores will drain off instantly, leaving a smooth black coat about $\frac{1}{100}$ of an inch thick, without any runs or streaks. This will leave the hole approximately $\frac{1}{100}$ of an inch larger than the steel core, varying somewhat on account of the size and shrinkage.

The composition is supplied by the S. Obermayer Co., in two grades already prepared, designated as A and B. The A grade is made for general work, light to medium; the B more especially for heavy castings, which, remaining liquid for some time after pouring, will burn off the A grade too much and make too tight a fit. If the A grade is used for heavy work on extra occasions it should be used thicker than under normal conditions. There is no other way than by dipping that a satisfactory coating can be put on and it is not advisable to try to dip the second time without cleaning off smoothly. The composition is a mixture of the most refractory and non-conducting substances known, which are held in suspension by a specially manufactured medium which is completely evaporated by the heat of the iron before they come into actual contact. Its non-conductive quantities are surprising. It would hardly seem reasonable to suppose that a coating of .01 of an inch thick would prevent the usual

"chilling" of the iron. But how effective it is can be proven by placing two chills of equal size against a light bar, as shown in Fig. 11, one being coated with the composition and the other not. The gate should be placed between the two for absolute fairness.

Like all good things, it is best to use steel cores with moderation. They will not do everything; they must be treated with consideration, and coaxed, if need be. The experience every foundryman has had trying to cast around wrought iron will be applicable to their use with all differences in favor

of the coated cores. In the hands of a foundryman willing to put up with a few unexpected results and to cultivate their good side they become very effective labor and cost reducers.

$100,000,000 More for the British Navy.

The British navy-building programme for the coming year has just been announced. The total cost of the navy for the coming year is estimated at £21,838,000, as compared with £21,823,000 for the previous year. The programme includes four battleships, three third-class cruisers, two sloops, four twin-screw gunboats, two torpedo-boat destroyers. The design of the battleships is not yet settled. The cruisers will be 2,135 tons displacement, and will carry eight 4-inch and eight 3-pounder quick-firing guns. The battleships are to be completed in the year 1899–1900; the cruisers in 1898–99. Three of the battleships, all three cruisers, and the two sloops are to be built in the Royal dockyards; one battleship and the remaining smaller vessels will be built by contract. The propelling machinery and boilers for all the vessels, except for two third-class cruisers and one of the sloops, will be ordered from private firms. Thus the total number of vessels of all classes under construction during the year will be 108. Their aggregate displacement will be about 380,000 tons, and the aggregate indicated horse power about 800,000. It is anticipated that in the next financial year 66 of these vessels will be completed for service, including 50 torpedo-boat destroyers.

It can well be understood that an annual expenditure of $100,000,000 by the British Government is a very important contribution to the activity in iron and steel and engineering establishments.

A GREAT many railroad companies have decided to put down heavier steel rails this season, for the following reason: The difference between the prices of the old and the new rails is now about $4 per ton, against $12 formerly, and this figures up about as follows: If a company wants to substitute an 80-lb. rail for a 60-lb. rail it has to pay say $20 a ton for 125 tons, and receives $16 per ton for 94 tons, leaving the net cost $996. Formerly, to do this would have cost $1,996, or double the present cost. This difference is a big stimulus and is likely to lead to an extensive movement to substitute heavier rails for lighter ones. This in the end will not only increase the steel rail business but must result in a great saving to the companies in operating expenses.—[Wall Street Journal.

THE Engineers' Society of Western Pennsylvania, at its regular meeting, March 16, was addressed by one of its ex-presidents, W. G. Wilkins, of the well known Pittsburg engineering firm, Wilkins & Davison, on his specialty "Electricity in Mining." The address was accompanied by stereopticon views. A committee was appointed to prepare a memorial of M. K. Moorhead.

REMOVING PAINT FROM IRON BY SAND-BLAST.

The *Engineering News* chronicles an interesting experiment with the sand blast in a recent issue. The old paint, oxide and scale on the steel hull of the U. S. Cruiser Atlanta was to be removed, and a test was made of the value of the Tilghman sand blast apparatus for this purpose, at the dry dock of the Brooklyn Navy Yard on March 1. The test was made under the direction of Ward & Nash, of Boston and Chicago, general agents for the sale of the Tilghman sand blast machinery in the United States and Canada. The *Engineering News* reports the experiment as follows:

"The test was made under direction of Messrs. Ward & Nash, of 23 Purchase st., Boston, Mass., general agents of the sand blast machinery for the United States and Canada, and of Mr. John F. Honey, their New York representative, of 25 Whitehall st., New York City. The test was made in the presence of Naval Constructor Bowles and other officers of the Navy. The apparatus consisted of a Blake direct-acting air compressor, which furnished air at a gauge pressure of 15 lbs. per sq. inch, a small air tank or receiver, a sand tank, containing a hopper which delivered the sand to a nozzle in which the air came in contact with it, insuring a thorough mixture of sand and air, a two-inch rubber hose about 30 feet long, and a delivery nozzle with opening about one-half inch diameter. A portion of the steel hull of the vessel was marked off into spaces five feet square, and the blast was applied by a workman who held the nozzle from four to six inches from the surface. The hull appeared to have been originally well painted with a coat of red lead, and one or two coats of a dark colored paint which had been abraded in spots showing the red surface beneath. Several workmen were engaged in scraping the paint on other portions of the hull by means of ordinary scrapers, which removed entirely the outer coatings of paint, but only partially removed the red lead. The surface of the steel was somewhat scarred and pitted, and it was not possible for the ordinary scraping tool to reach the bottom of the numerous depressions. When the sand blast was applied, however, not only were the outer coatings removed, but every trace of the red lead also, and likewise the black oxide on the surface of the steel itself, even to the bottom of the deepest pittings, exposing the clean gray metallic color of the steel. The degree of perfection of the work seemed to depend upon the skill of the workmen. When he was careful to keep the blast long enough on every portion of the surface, it was made of a uniform light gray color throughout, but if in order to do more rapid work he moved the blast nozzle too rapidly, or was not careful to go thoroughly over every portion, the surface would show dark spots, due to the imperfect removal of the black oxide of iron. If he held the nozzle at an angle to the surface the sand would not strike the bottom of the pittings, which would appear as small black spots. The speed of the work was somewhat variable, three squares of 25 sq. ft. each being cleaned, respectively, in 16, 20 and 19 minutes, including a few short stoppages during each period, required for adjusting the flow of sand or for refilling the sand hoppers. Two kinds of sand were used, one a white sand with many black specks, having the appearance of crushed granite, and the other a brown building sand. The latter was more uniform in grain, and in general finer than the former, and appeared to be capable of doing more rapid work. About a barrel of sand was used during the hour occupied by the test. The sand was not saved but was allowed to fall to the bottom of the dock, a considerable portion being blown into the atmosphere in the shape of dust. It was evident that the greater portion of the sand might have been saved and used over again. It also appeared that a larger sand nozzle might have been handled by the workman, so that the speed of his work might have been at least doubled. On the whole, the test was eminently successful, and we see no reason why this method of cleaning the hulls of steel vessels and other large surfaces of iron and steel should not meet with general adoption."

Since the test was made, Ward & Nash have closed a contract to treat the entire steel hull with the sand blast, to remove all the paint, oxide and scale.

THE directors of the Cambria Iron Co., last week, declared the regular semi-annual dividend of two per cent.

"WHERE IGNORANCE IS BLISS--"

Somebody is losing money and doesn't know it.

We attribute it to the fact that there are thousands of steam users who have never heard of the Cochrane Heaters, or, having heard of them, have not investigated them or compared them with those they do know. These Cochrane Heaters are better than the ordinary run—are better than the extra good—are better than any other appliance for a similar purpose that is sold on the market to-day, yesterday, or ten years ago. Perhaps we lack in modesty in saying this ourselves, as our customers have been and are saying it for us. But then until you happened to meet them you would be losing the advantage of a good thing—a very good thing—so we decided to pocket our pride and tell you direct. Not our word for it that these Cochrane Heaters can *thoroughly* free your exhaust steam from cylinder oil, (there are nearly a thousand of our oil separators you can refer to before you need fall back on us) that they can heat water about as hot as exhaust steam can make it, can give you "real purification," etc., and do all this without getting out of order. What do they cost? Oh! They're gilt-edged! Ask us, stating how much water you want to heat, how much exhaust steam you have and whether you want to heat your building or a dryer.

Nearly 12 years ago we commenced building these Cochrane Heaters.

HARRISON SAFETY BOILER WORKS,
PHILADELPHIA, PA.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Lake City Engineering Co. has been organized at Erie, Pa., with a capital stock of $15,000, and will engage in the manufacture of boilers and engines.

Erwin Welch, 35 S. Canal st., Chicago, is in the market for a 24-inch drill press and 18 inch or larger, shaper.

H. G. Cotton, Ottawa, Ill., wants to buy a 60 to 100 h. p. Corliss engine in good order.

New Construction:—

The Wilkinsburg, Pa., Water Co. will erect a pumping station at once. J. H. Harlow & Co., Pittsburg, are engineers.

A new county bridge will be built across the Shenango River at Sharon, Pa.

The Dickson Mfg. Co., of Scranton, Pa., has commenced the construction of a new boiler shop 130 feet wide and 225 feet long. This building will have a steel framework throughout. The sides will be covered with corrugated iron and the roof with composition roofing on plank. The main boiler shop is about 52 feet wide and 45 feet high. Thirty feet above the ground is a runway made of substantial steel girders which carry a 30 ton power traveling crane. At one end of the main shop is a riveting tower 25 feet by 50 feet, having a runway carrying a 20 ton crane 50 feet above the floor level. The crane in the riveting tower runs at right angles to the one in the main shop below. Adjoining the main shop is a punch room which is about 50 feet wide extending the full length of the building. Attached to the roof trusses of this portion is a traveling crane of five tons capacity, which covers the whole floor surface. Adjoining the punch shop is a space for the flange fires and other furnaces, 25 feet wide and 225 feet long. All the main posts of the building are arranged so that jib cranes can be attached to them, and the trusses are arranged so that shafting and other machinery may be attached at convenient points. This building when completed will be without doubt the handiest and best equipped shop of its kind in the country. The steel work was designed and will be furnished and erected by the Berlin Iron Bridge Co., of East Berlin, Conn.

The Colorado Fuel & Iron Co. is now securing estimates for building, at Pueblo, Col., four new mills for the manufacture of steel rails and structural iron at a cost of about $500,000, one for making ingots, another steel rails, the third structural materials and the fourth steel plates. The company is securing estimates for putting in six electric cranes and other extensive machinery.

The Herried Bros. Mfg. Co., Blair, Wis., will erect a 40x48 foot factory, with an engine room 24x24 feet. A 30-h. p. engine and 45-h. p. boiler will be installed.

Dawes & Myler, of New Brighton, Pa., have torn down three detached enameling buildings, and are to put up in place of the three one building, 160x40 feet.

Additions, Enlargements, Removals, Etc.:—

It is reported that the G. D. Sheriffs Mfg. Co., of Port Washington, Wis., will remove to Bay View, Milwaukee. The concern manufactures malleable iron, and employs about 150 men.

The George V. Cresson Co., of Philadelphia, Pa., will soon commence work on an addition to its present plant. The new building will be of brick and iron, 40x130 feet, and will be used as a machine shop.

It is reported that the removal of the Wheeling & Lake Erie shops from Norwalk to Massillon has been decided on by the receivers. Norwalk contributed $32,000 to get the shops originally.

Fires and Accidents:—

Fire in the main building of the Sprague Elevator Co.'s works, at Watsessing, N. J., March 9 caused a damage of about $25,000, covered by insurance. The fire is believed to have been the work of incendiaries.

General Industrial Notes:—

The directors of the Birmingham Rolling Mill Co., Birmingham, Ala., have authorized the issuance of $75,000 additional stock. The proceeds will be used in the erection of the proposed steel plant.

The new Hoffman, Billings & Weller Mfg. Co., Huntsville, Ala., has elected the following officers: President, W. H. Weller; vice-president, F. Hoffman; secretary, G. Schumaker; treasurer, J. B. Kalvelage. The company will have a daily capacity at its plant in Gadsden of 45 tons of pipe. Enlargements will be made at once.

Locomotive and car building reported by the *Railroad Gazette:* The Houston & Texas Central and the Lake Shore are each in the market for five locomotives. The Mexican Central placed an order with the Brooks Locomotive Works for 21 ten-wheel simple engines. Four engines divided among three roads have just been taken by the Baldwin Locomotive Works. The Erie Road has placed 24 Wootten boilers with the Rogers Locomotive Co., Paterson, N. J. The Pennsylvania Co. is in the market for 200 cars; the Pittsburg & Lake Erie for 1,000 cars; the St. Louis, Vandalia & Terre Haute for 175 cars. The B. & O. has placed an order, said to be for 3,000 cars, with the Pullman Co.; and the Mexican Central has given the Michigan-Peninsular Car Co. a contract for 635. The order of the Pittsburg, Bessemer & Lake Erie, it is thought, will be for 600 steel cars.

Riter & Conley, of Pittsburg, have received a contract for the structural work for the new blast furnace to be erected by King, Gilbert & Warner, at Columbus, O.

The McCool Tube Co., Beaver Falls, Pa., has started its plant and is now regularly manufacturing cold drawn seamless tubes. It will not only make tubing for bicycles, but also for bedsteads and other special lines, including boiler tubes.

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick

GOVERNMENT ‡ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

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"THE IRON TRADE REVIEW"

is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

The I. W. Bollinger Co., The Rookery, Chicago, are general sales agents.

The Board of Trade, of Sharpsville, Pa., is endeavoring to induce the Derwent Foundry Co., whose plant at Ellwood City, Pa., was destroyed by fire some time since, to rebuild at Sharpsville.

E. Harrington, Son & Co., Philadelphia, Pa., are shipping a lathe to Mexico and have recently shipped two of a similar kind to South America. From both these countries the orders were to ship the lathes in sections and to pack them in boxes of about 350 pounds each, so that they could be carried on mule back across the mountains to points of destination. The same firm are making shipments of machinery to China and Japan, chiefly for use in the mints of the countries named.

The Crescent Steel Co., of Pittsburg, will soon be prepared to reinstate its cold rolling department and furnish cold rolled product of the different grades.

LaBelle Iron Works, Wheeling, W. Va., will build additional tin mills if the city council vacates a portion of a street to give room.

The Shiffler Bridge Co., of Pittsburg, Pa., has received the contract for the iron building to contain the new plant of the McKenna Steel Working Co., at Joliet, Ill. The latter company will reroll old steel rails.

In Pittsburg courts last week W. J. Rainey brought suit for $50,000 damages against the McClure Coke Co. The plaintiff alleges that in 1886 he entered into an agreement with the McClure Co. to manufacture coke in Westmoreland county and that his share of the business is the amount asked for.

At Youngstown, O., suit was begun last week by the Andrews Bros. Co., against Mary B. Bonnell, executrix of Henry O. Bonnell, deceased. The plaintiffs claim $11,852.12 on coke contracts made by them July 7, 1888, at 95 cents a ton, with the Youngstown Coke Co., with works in Fayette Co., Pa. The coke company, it is alleged, repudiated its contract Dec. 24, 1888.

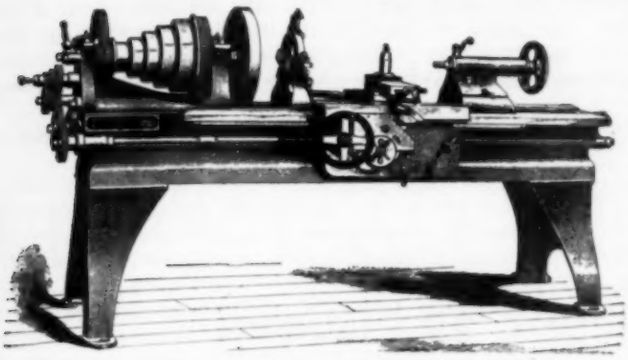
At Johnstown, Pa., No. 1 rail mill of the Cambria Iron Co., closed during the past year, has resumed.

The Cleveland plant of the Consolidated Steel & Wire Co. is being operated, in spite of the refusal of the local rod-mill workers to resume. The men at work in the rod mill are from other plants of the company. No effort is being made at present to fill orders, but stock is being worked up. The scale of the company, on which its other plants are run, is not made public and the men are asked to go to work without an announcement of it. They insist, however, on the Cleveland rod mill scale, and that all the men in the employ of the company at the time of the trouble last year be taken back.

The furnaces of the Riverside Iron Works, in the Wheeling

U. BAIRD MACHINERY CO.

123 AND 125 WATER STREET, **PITTSBURG, PA.** 124 AND 126 FIRST AVENUE.



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Brass Founders, Iron Pipe Fitters and Machinists,

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Phosphor Bronze ("Elephant Brand") Castings, Coolers, Tuyeres and Cinder Notches for Blast Furnaces supplied promptly.

Rolling Mills, Steel Works, Blast Furnaces Coal and Coke Works, Power Houses for Electric Street Railways, etc., promptly fitted up by Experienced Workmen.

AIKEN Duplex and CRITCHLOW Valves, either three or four way, for operating Mill and Hydraulic Machinery of all kinds under any desired pressure, and Stop Valves for same.

Agents for the CAMERON STEAM PUMP, which is made in every possible variety, and suitable for all purposes to which Steam Pumps can be applied.

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THE SUPERIOR CHARCOAL IRON CO.,

Exclusive Sellers of the Following Well Known Brands of

LAKE SUPERIOR CHARCOAL PIG IRON,

Antrim, Elk Rapids, Gaylord, Hinkle,
Peninsular, Pioneer. Spring Lake, Union.

All business connected with the sale of the above brands of Charcoal Pig Iron will, from April 1st, 1897, be handled by THE SUPERIOR CHARCOAL IRON CO., of Detroit, Mich., which is thus enabled to supply the best iron known for all purposes, especially for Car Wheels, Malleable Castings, Boiler Tubes, Ship and Armor Plate, strong high Silicon for foundry purposes, Basic Pig Iron with the minimum of Silicon and Sulphur, also iron to take the place of Salisbury, Southern, and Swedish Charcoal Iron.

OFFICERS { WM. G. MATHER, Prest. / W. H. HINKLE, Vice Prest. / F. B. GAYLORD, Secy. & Treas. / J. C. HOLT, WM. GERHAUSER, } Sales Managers.

Office, 66 Newberry Bldg., DETROIT, MICH.

district, which have been steadily in blast for a long time have gone out. The company has a considerable stock of iron on hand.

In the discussion which followed the reading of the paper on "Friction Horse Power in Factories," by Prof. C. H. Benjamin, of the Case School of Applied Science, Cleveland, at the last annual meeting of the American Society of Mechanical Engineers, the question was asked by some one, "What has become of all the metaline, fibre graphite and other people?" and as none of them appeared to be directly represented, the question went unanswered. The North American Metaline Co., 40 to 48 Third st., Long Island City, N. Y., writes to say that for itself, it is far from being out of business. Six years ago the company purchased a plot of ground and erected a brick factory building, adapted to the requirements of its line of manufacturing, and established a brass foundry, for making its own gun metal and composition castings. Since that time it has been doing a very successful business in supplying metalined or oilless bearings for use in pulley block and wire rope sheaves, loose pulleys, light line and countershafting, etc. The use of metaline is not adapted to all classes of bearings, the Metaline Co. says, but it adds that it confines its efforts to the specialties in which it knows it to be a success

The puddlers of the E. & G. Brookes Iron Co., at Birdsboro, Pa., have returned to work at $2.25 a ton. The helpers will get 22½ cents a heat. In November last the price of puddling was reduced by the company from $2.75 to $2.25. The puddlers refused to accept the latter rate and have been idle ever since. Last week they held a meeting and decided to resume.

At the annual meeting of the stockholders of the Pottstown Iron Co., the election for directors resulted in the choice

of B. S. Janney, Sr., Andrew Wheeler, Austin Heckscher, Theodore H. Morris, George T. Barns, Charles E. Henderson, and H. A. Berwind.

The rolling mills of Lancaster, Pa., and also of Columbia, have posted notice of a 10 per cent reduction in wages, to conform to a similar reduction made by the Harrisburg and Lebanon mills.

The Aetna Foundry & Machine Co., of Warren, O., has received an order from the Beaver Tin Plate Co., Lisbon, O., for a special long roll tin machine to coat plates as heavy as 18 gauge and as wide as 44 inches. The rolls are to be 48 inches long in body and four and one-half inches diameter.

The two additional tin mills of the New Castle Steel & Tin Plate Co., New Castle, Pa., have been completed, and put in operation. This gives the company 18 hot mills.

The Magnolia Metal Co., 74 Cortlandt st., New York, closed its fiscal year on March 1. It finds that its sales of Magnolia metal in the United States have been 25 per cent larger than they were in the year before and that the volume of business exceeded that of any previous year in the past ten years. This has nothing to do with the European business which was found to be larger than the American business. The prospects for the ensuing year are reported to be good and the company expects that it will be a still better one. On May 1, the offices of the company will be changed from 74 Cortlandt st. to Nos. 266 and 267 West st., where it will occupy the entire buildings. This change is made to give increased facilities for storage, shipping, etc.

The statistics showing production of iron, coal, coke, etc., in Alabama in the month of January have been collected by State Geologist Smith for the Alabama Industrial and Scientific Society. This being the first month of the effort to carry on this work systematically, the returns are imperfect and are said to represent only about 75 per cent of actual production. They show 416,858 tons of coal, 92,112 tons of coke, 132,713 tons of iron ore and 60,352 tons of pig iron.

The Pennsylvania Steel Co. will roll most of its T rails hereafter at the plant of the Maryland Steel Co., at Sparrow's Point, Md. Girder rails will be rolled at Steelton, as heretofore. At the Bessemer plant at Steelton very heavy outputs have been made lately.

At Youngstown, O., the American Tube & Iron Co. reduced wages 10 per cent on March 20.

The Foos Gas Engine Co., at Springfield, O., has been reorganized with $50,000 capital, P. P. Mast having sold out his half interest. The directors of the new company are: John Foos, Scipio E. Baker, George Foos, Robert H. Foos, and E. N. Lupfer.

The Sebastian Lathe Co., of Cincinnati, has recently received a number of orders for its lathe for export to foreign countries. Among the destinations are Amsterdam, Holland; Coppenhagen, Denmark, and Coventry, Eng.

The Bethlehem Iron Co., Bethlehem, Pa., whose plate mill product is referred to elsewhere, has been turning out a very satisfactory product in the past six months, both in sheared and universal plates.

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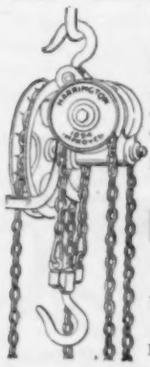

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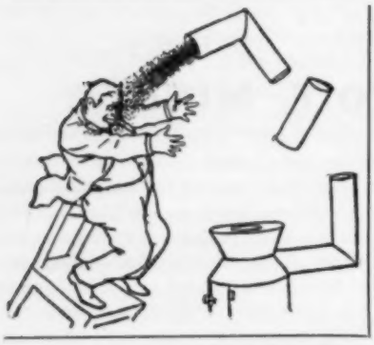

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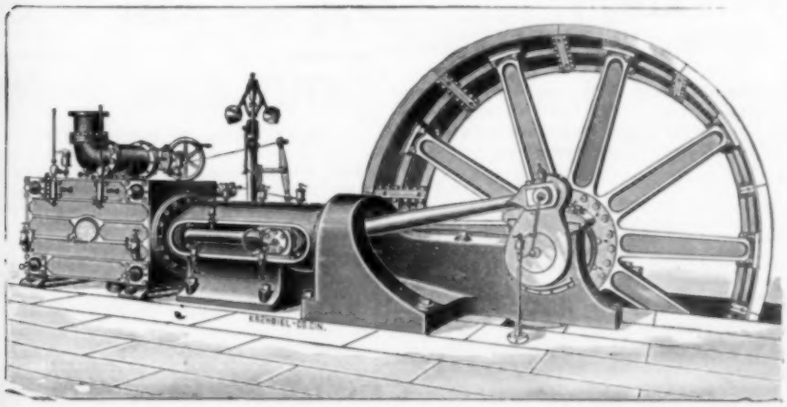

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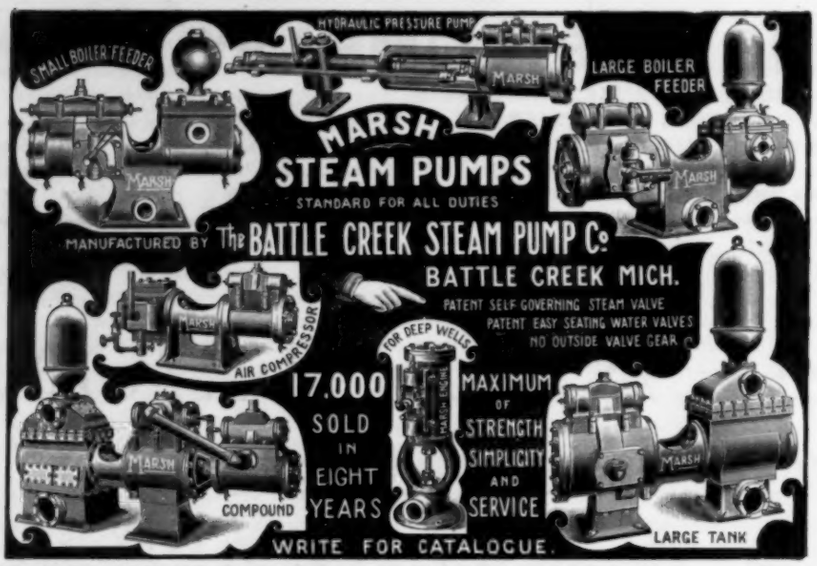

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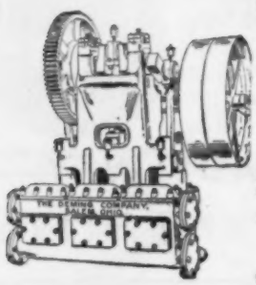

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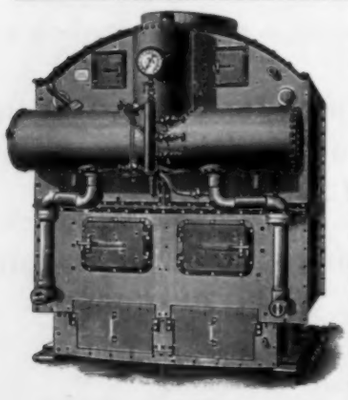

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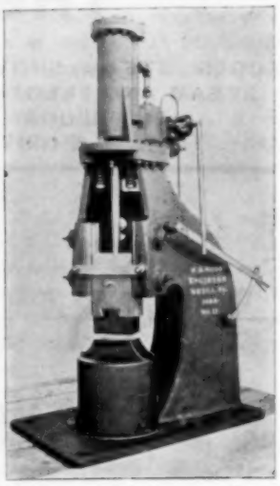

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Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
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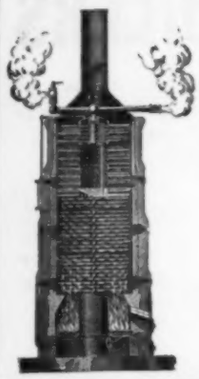

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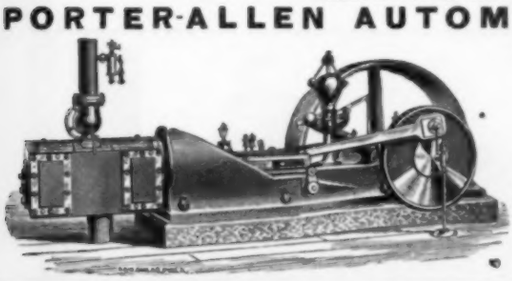

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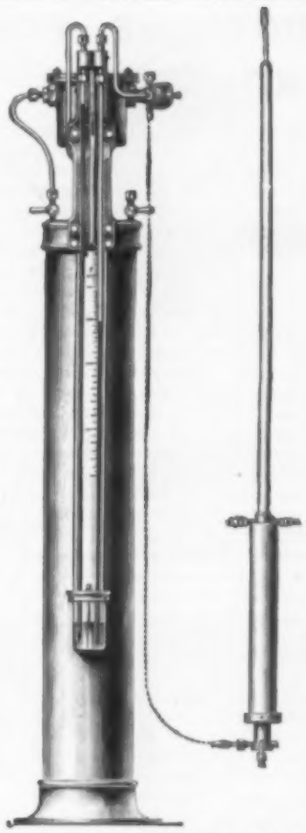

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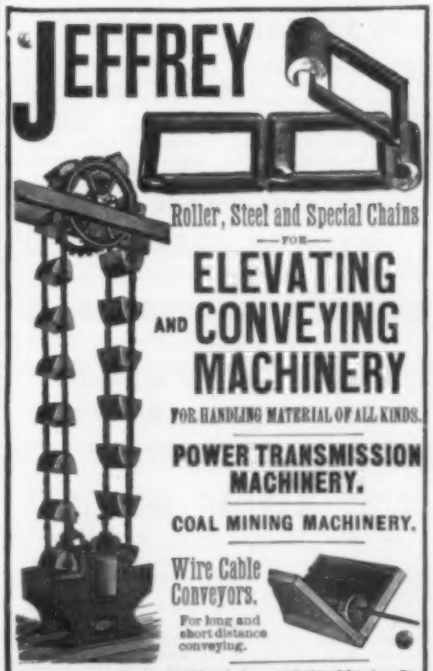

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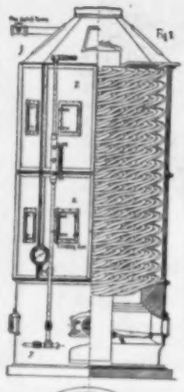

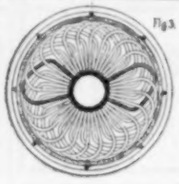

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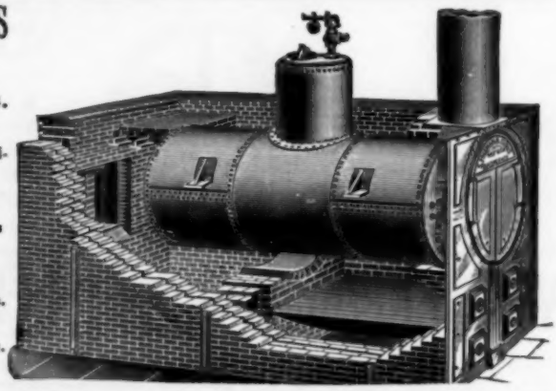

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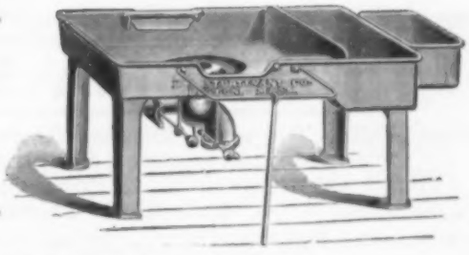

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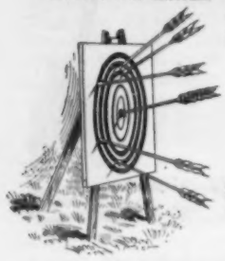

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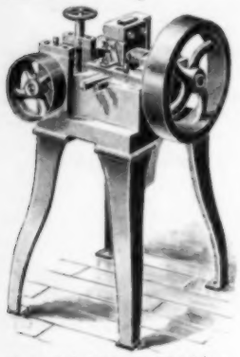

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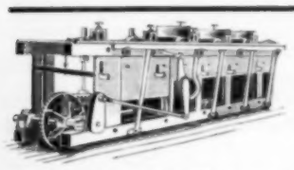

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Cambria Iron Co., johnstown, Pa.
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Ætna-Standard Iron & Steel Co., Bridgeport, O.

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Mining Machinery—
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The Lane & Bodley Co., Cincinnati, O.
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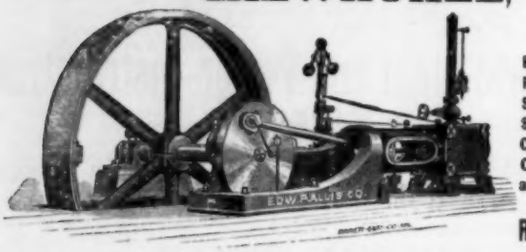

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No. 1 Bessemer hematite	4.00@4.25
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No. 2 Strong Foundry	10 15@10 40
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No. 2 Gray Forge, neutral	... ... 9 75
No. 1 American Scotch	... ... 11 40
No. 2 American Scotch	... ... 10 90
Lake Superior Charcoal	... ... 13 50

PITTSBURG:

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No. 2 Foundry	10 25@10 50
Gray Forge	... ... 9 50
White and Mottled	... ... 9 25
Warm Blast Charcoal	15 00@16 00
Cold Blast Charcoal	... ... 20 00
Bessemer	10 40@10 65

CHICAGO:

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	11 25@11 75
Local Coke Foundry No. 2	10 75@11 25
Local Coke Foundry No. 3	10 50@10 75
Local Scotch Foundry No. 1	11 25@11 75
Local Scotch Foundry No. 2	10 75@11 25
Local Scotch Foundry No. 3	10 50@10 75
Southern Coke No. 1	11 00@11 25
Southern Coke No. 2	10 25@10 40
Southern Coke No. 3	10 00@10 15
Southern No. 1 Soft	10 65@10 90
Southern No. 2 Soft	10 15@10 25
Southern Silveries	11 40@11 60
Jackson Co. Silveries	14 00@16 05
Ohio Silveries No. 1	15 00@15 50
Ohio Silveries No. 2	14 50@15 05
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Alabama Car Wheel	16 00@16 50
Malleable Bessemer	12 00@12 25
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Southern Coke No. 2 and No. 1 Soft	9 75
Hanging Rock Coke, No 1	12 50@13 50
Hanging Rock Charcoal No. 1, Fdy	15 00@16 00
Tennessee Charcoal No 1	13 00@14 00
Jackson County Silvery No 1	13 00@14 00
Southern Coke, Gray Forge	... ... 9 00
" " Mottled	... ... 9 00
Standard Alabama Car Wheel	14 75@15 50
Tennessee " "	13 50@14 50
Lake Superior " "	14 75@15 25

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Lake Superior Charcoal	... ... 14 00
Southern Soft No. 1	... ... 12 00
Hanging Rock Charcoal	... ... 17 00

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Southern Coke No. 2	... ... 10 50
Southern Coke No. 3	... ... 10 00
Southern Gray Forge	... ... 9 75
Southern Charcoal No. 1	... ... 15 00
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Old iron rails	$12 50
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1 to 1¾	1.20 Base
2 to 3½	.20 extra
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3⅝ to 4	.80 "
4⅛ to 4½	1.00 "
4⅝ to 5	1.30 "
5⅛ to 6	1.80 "
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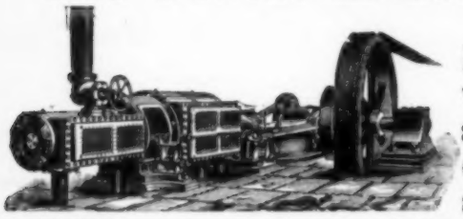

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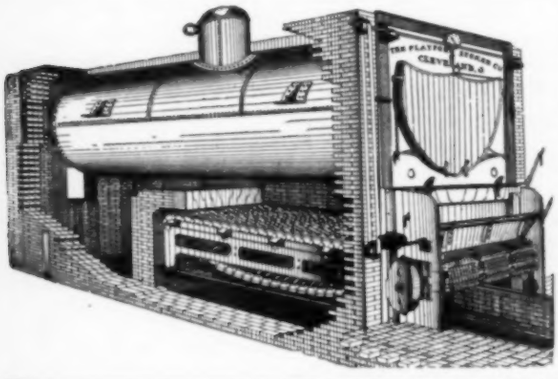

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IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

6⅝ to 7¾	2.50 extra
¾ to ⅞	.10 "
⅞ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 11-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1½ to 4 x ⅜ to 1	1.20 Base.
4¼ to 6 x ⅜ to 1	.10 extra.
6¼ to 8 x ⅜ to 1	.60 "
8¼ to 10 x ⅜ to 1	.80 "
1⅜ to 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅜ to 1½ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ¾	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
⅜ to 9-16 x ⅜ to ⅜	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1½ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅛ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

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7 to 8 x No. 9 to 3-16	.90 extra.
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¾ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40 "
⅜ x No. 9 to 3-16	1.50 "
⅜ x Nos. 10, 11 and 12	1.60 "

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in. .70

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅜	.40 extra.
¾ to 13-16	.50 "
⅝ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
⅝ to 11-16 x ⅛	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra.
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅝ to 11-16	.90 "
½ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes .1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.
		Extras.
1½ to 6,	" 10, 11, 12 or 1/4"	.05 per 100 lbs.
1 to 1¾,	" 7, 8, 9 or 3-16"	.10 "
1 to 1¾,	" 10, 11, 12 or 1/4"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or 1/4"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10 11, 12 or 1/4"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10 11, 12 or 1/4"	.45 "
½,	Nos. 7, 8, 9 or 3-16"	.55 "
½,	" 10, 11, 12 or 1/4"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-19	" 10, 11, 12 or 1/4"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or 1/4"	1.05 "

Iron and Steel Hoops.

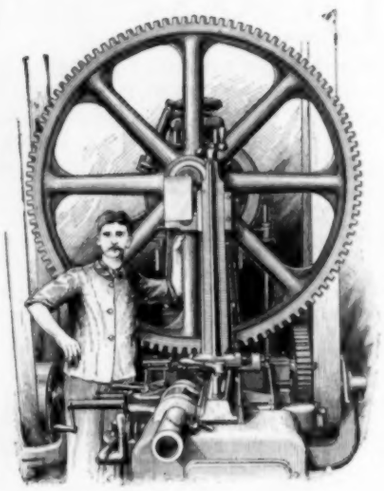
Width in Inches.	English Standard Gauge.	
1 7-16 to 3	Nos. 13, 14, 15 and 16	1 60 Base
		Extras
1 7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs.
1 7-16 to 2,	" 20	.10 "
1 7-16 to 2,	" 21	.15 "
1 7-16 to 1¾,	" 22	.25 "
1 ⅛ to 1⅜,	" 13, 14 and 15	.05 "
1⅛ to 1⅜	" 16, 17 and 18	.10 "

R. D. NUTTALL CO.,

99 BOQUET STREET, ALLEGHENY, PA.

THE SUPERIORITY OF

Cut Teeth Over Cast Teeth



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Rolling Mill and Bridge Work

Has been fully demonstrated, both in the life of the Gear and greater efficiency.

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FURNACES, FLASKS, FOUNDRY Supplies and Specialties.

Send for our Catalogue and look at the Ribbed Flask.

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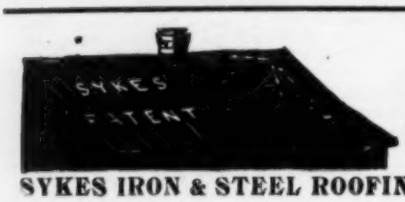

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We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of **METAL ROOFING, SIDING, CEILING, ETC.** Send for Catalogue and Price List. Mention this paper.

SYKES IRON & STEEL ROOFING CO., • Chicago and Niles, O.

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CINCINNATI, OHIO.

Engines,

ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

1⅛ to 1⅜,	"	19 and 20	.15 per 100 lbs.
1⅛ to 1⅜,	"	21	.20 "
1⅛ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos.	13, 14 and 15	.20 "
⅞,	"	16, 17 and 18	25 "
⅞,	"	19 and 20	.30 "
⅞,	"	21	.35 "
⅞,	"	22	.45 "
¾ and 13-16	Nos.	13, 14 and 15	.30 "
¾ and 13-16	"	16, 17 and 18	.35 "
¾ and 13 16	"	19 and 20	.40 "
¾ and 13-16	"	21	.45 "
¾ and 13-16	"	22	.50 "
¾ and 13-16	"	23	.60 "
11-16,	Nos.	13, 14 and 15	.35 "
11-16,	"	16, 17 and 18	.40 "
11-16,	"	19 and 20	.50 "
11-16,	"	21	.60 "
11-16,	"	22	.70 "
11-16,	"	23	.80 "
⅝,	Nos.	13, 14 and 15	.40 "
⅝,	"	16, 17 and 18	.45 "
⅝,	"	19 and 20	.55 "
⅝,	"	21	.65 "
⅝,	"	22	.75 "
⅝,	"	23	.85 "
9 16,	"	13, 14 and 15	.45 "
9-16,	"	16, 17 and 18	.50 "
9-16,	"	19 and 20	.60 "
9-16,	"	21	.70 "
9-16,	"	22	.80 "
9-16,	"	23	.90 "
½,	"	13, 14 and 15	.55 "
½,	"	16, 17 and 18	.60 "
½,	"	19 and 20	.70 "
½,	"	21	.80 "
½,	"	22	.90 "
½,	"	23	1.00 "
7-16,	"	13, 14 and 15	.80 "
7-16,	"	16, 17 and 18	.90 "
7-16,	"	19 and 20	1.00 "
⅜,	"	13, 14 and 15	1.00 "
⅜,	"	16, 17 and 18	1.10 "
⅜,	"	19 and 20	1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2 10
No. 25-26	2 20
No. 27	2 30

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

The Link-Belt Machinery Co.

ENGINEERS. FOUNDERS. MACHINISTS.

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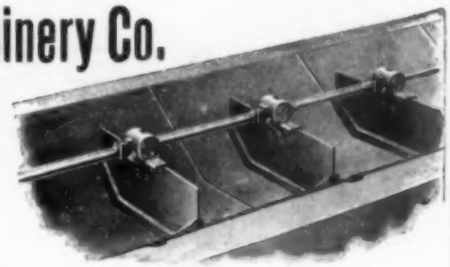

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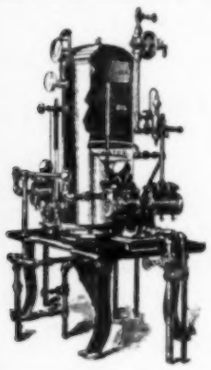

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The A B C of Iron.—A book for foundrymen. It is issued in cloth binding, and gives much valuable matter on how to reduce cost of mixtures, and on grading and numbering of pig iron. Former price $2.00, NOW $1.00. Order of *The Iron Trade Review Co.*, 27 Vincent St., Cleveland, O.

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REACHING with its 7,966 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and and Soft Lumber Districts located in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

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General Freight Agent,
CHICAGO.

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Varine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special.

Flats. cts. lbs.

2 to 9-16 in. wide by 2 to ⅝ thick .08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON. cts lbs.

1 to 2 in. inclusive	.08
9-16 to ⅞ in. "	.08
7-16 to ⅜ and 2⅜ to 3 in	.09
3⅛ to 4 in	.09½
⅜ to 11-16 and 4½	.10
⅛ to 6 in	.10½
¼ to 9-32 and 6½ to 7 in	.11
1 in	.13

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 10
Bridge ⅝, ⅜, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black, base, four 10s	.62
Butt " " four 10s	62½
Lap " galv. " four 10s	52½
Butt " " " four 10s	50
Boiler tubes 2¼" and smaller	.70
Boiler tubes 2½" and larger	.75
Casting screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

[From Store, Cleveland.]

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's dis 40
	Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 10 to 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	
Morse Taper & Straight Shank to 1¼"	dis 50 & 10 to 60
Morse Taper and Straight Shank Larger than 1¼"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60@60&5
Cleveland " "	dis 60@60&5

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150 gr.	Flour. F. F
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4½c	5½c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 50@50&5
H. H. Barton.....dis 50@50&5

Emery Wheels.

Detroit.....dis 60@70
Norton's.....dis 60@70
Grant.....dis 60@70
Sterling.....dis 60@70
Celluloid.....dis 10&33⅓
Northampton.....dis 50
Crystal.....dis 65@70
Vitrified.....dis 60@70
Vulcanite.....dis 60&10
Hamden.....dis 60&10@70
Cyclone.....dis 60@60&10

Files.

Arcade.....dis 60&10@60&10&10
Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
McClellan.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs.....10c
" " " " over 5 lbs.....8c

Jack Screws.

Illinois Bolt Co. list.....dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15⅝	11⅝	8⅝	6	5¼	5¼	
Washers	9	8	7	5	4½	4½	4⅛

In lots less than 100 lbs, ₩ lb add ¼c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, ₩ keg, base.
Car lots.....$1.50
Less than car lots.....$1.60

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Rivets.

Iron, Thousand, list November 1, 1894.....dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894.....dis 60@65
Copper.....dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list.....dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 55
Pulley Taps.....dis 40

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

New List, Apr. 9, 1894

Brass.....dis 35c
Copper.....dis 35c
Bright and annealed, Nos. 0@18.....dis 70&10@75
" " Nos. 19@26.....dis 75@75& 5
" " Nos. 27@36.....dis 75&10& 5
Coppered Nos. 0 to 18, market list.....dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis65& 5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....95c ₩ lb dis 30

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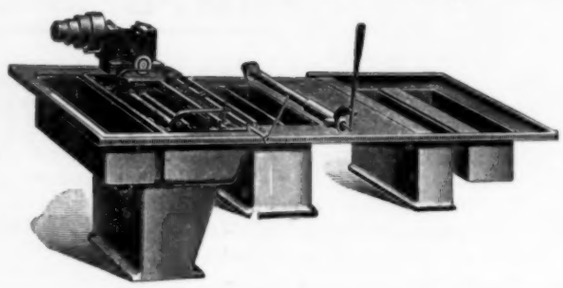

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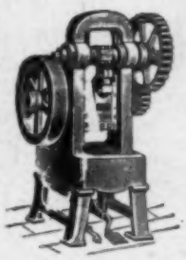
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TOLEDO MACHINE & TOOL CO.,
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Special and Automatic Machinery Dies for all classes of work in sheet metals.
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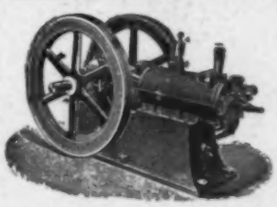

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The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength.
Catalogue sent on application.
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Our Sand is SECOND TO NONE. Banks at Conneaut and Kingsville. Samples and Prices on Application.
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MACHINERY FOR HANDLING COAL AND ORE.
CRANES
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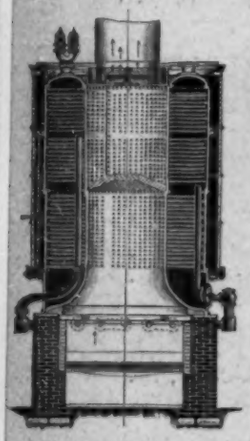

We have undertaken to exploit
Berry Safety Boiler.

WHY?

Because after watching it in the
rdest kind of service for two
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embodies in its construction
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iler ever built.
It will be manufactured at the
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icago, which fact alone is a
arantee that both material and
rkmanship will be the best
at money can buy.
Some of the good points of the
rry Boiler are the following:

It gives uniformly DRY STEAM.

It is SAFE and durable.

Is economical in first cost.

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gives the greatest horse-power per square foot of floor space occupied.

Send for our descriptive pam-
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hole story.

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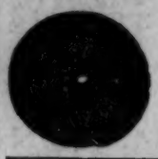

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District Manager, No. 911 Chicago Opera House Block, Chicago, Ill., or Box 84, Columbus, O.

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INCORPORATED.

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SHIPPERS OF STANDARD MOLDING SAND AND FIRE CLAY.

Adapted to Castings of Any Nature.

Location of banks: Newport and Covington, Ky., Delhi and Hamilton, O., and Jeffersonville and Connersville, Ind.

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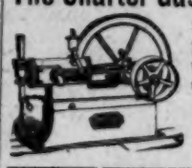

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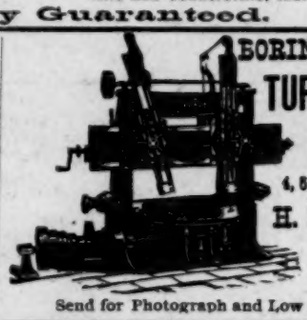

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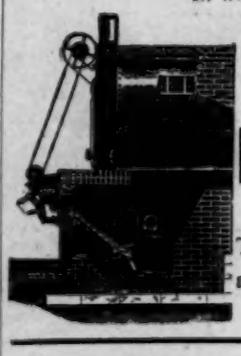

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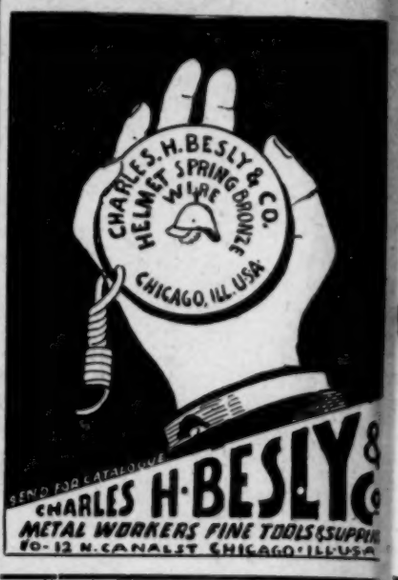
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